Designing and Evaluating Virtual Persuasive Agents in providing Social Support for Web-based Learning Self-Efficacy in Nurse Education

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Abstract

Students learning in blended learning and classroom environments benefit from social interaction and vicarious learning experience with their peers and tutors. In comparison, students learning via self-directed Web-based learning cannot benefit from these advantages and may feel isolated.

This research investigates if the presence of virtual persuasive agents presented as avatars, happy images and encouraging text can provide social support similar to real peers and improve students' Web-based learning self-efficacy (WBLSE). This research also examines if low and high fidelity virtual persuasive agents can provide social support in a similar way.

This study uses Bandura's (1982) self-efficacy theory as a framework for changing nursing students' beliefs in using the Web for learning. The basis for including virtual persuasive agents in this research stems from the media equation theory (Reeves & Nass, 1996) which holds that Computers are Social Actors (CASA) and that people respond to Web-based media as if they were social actors.

Adopting the User-Centred Design approach, a bespoke Web-based training package was developed for changing pre-registration and post-registration nursing students' WBLSE. In a quasi-experimental design, the package was delivered in three separate studies to different groups of pre-registration and post-registration nursing students. Several important findings contributed to the WBLSE body of knowledge. Overall, the training package was found to be effective with the nursing students' WBLSE improving equally in the intervention groups in all studies. Pre-registration students showed the greatest improvement when learning by self-direction supported by virtual persuasive agents, whereas post-registration students improved when learning in a blended setting without their support. Low-fidelity virtual persuasive agents were sufficient in providing social support for pre-registration students in self-directed settings. The implications for Web-based learning in nurse education, research and practice are discussed.

Publication arising from this thesis

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Chapter 1: Introduction

1.1 Overview

The ubiquity of the Internet and the World Wide Web (or the Web) has transformed the way we live, work and learn. Today, having access to the Internet is perceived to be a necessity for everyday life, not a luxury; and round-the-clock access to online information is almost the norm rather than the exception. Internet adoption and digital uses increase life satisfaction (Lissitsa and Chachashvili-Bolotin, 2016) by providing people with greater ease in obtaining information.

In healthcare, information and communications technology (ICT) has modified the way in which people use health services. Public access to information on authoritative online resources such as the National Health Services (NHS) Choices website has empowered service users and carers to seek understanding of health conditions (NHS, 2016). While and Dewsbury (2011) argue that healthcare providers look upon Web-based information as "a key component of modern healthcare delivery as healthcare moves from the 'face to face age' to the 'information age'" (While and Dewsbury, 2011, p1302). Taking their view, this suggests that healthcare providers including nurses must be prepared for delivering patient care that includes remote assessment of health need, information giving, diagnostics, support and monitoring of the patient's condition. In the UK, the Department of Health (2008) has identified a key role for ICT in improving health and healthcare through the provision of high quality care (defined as clinically effective, personal and safe) for patients and the public to include easy access to evidence-based medical knowledge.

Nurse higher education providers play an important part in preparing student nurses for the digital information age and "the continuing development of our information society" (Department of Health, 2009, p8). This realisation is indicated by nursing literature reporting that nursing academia is exploring various ways in which Web-based technologies can enhance the delivery of the nursing curriculum to ensure that it is evidence-based and fit for purpose.

Web-based learning (learning materials delivered via an Internet Web browser) has become more mainstream in higher education (HE), and although the level and consistency at which learning materials are made available to students is not clear (Gilbert, 2007), universities are investing in further development and integration of Web-based provision such as open educational resources, virtual learning environments and digital libraries. Moreover, general course organisation such as personalised timetables and assignment submission are increasingly available online (Buzzetto-More, 2008). In addition to investment in Web-based systems and infrastructure, HE is also investing in learning technology experts and IT support teams to develop online learning materials and provide training and support for students in using these systems (Lu, 2009). Yet, it is not clear if this investment is effective in supporting students who are not confident in using the Web for learning.

Much of the literature on Web-based learning (WBL), both in HE generally and nurse education specifically, reports on outcomes from the evaluation of specific online tools (such as discussion forums and blogs) that were used to deliver learning and students' general attitudes towards them (Gilbert, 2007). The theme of the study results appears to be that student learning and performance are either better or that there is no significant difference from the control groups (Nguyen,

2015). Even though these studies generally also report on the student positive or negative WBL experience, very few studies specifically explore how students are supported or trained in using the Web for learning. In other words, student requirements for support in using the Web for learning are often something that is discovered belatedly from self-reported evaluation at the end of a period of study. Although recommendations for support are then suggested such as face-to-face training or online guides and support (Piccoli et al., 2001), it is not clear that these recommendations are subsequently followed up.

These studies have identified a number of common support requirements, namely: isolation, dropouts, lack of knowledge and skills (Reilly et al., 2012) and recommended support. Few studies examined the underlying issue of supporting students who are learning online on their own who are not confident in using these technologies on their own or if support and training had long lasting impact. It is often assumed that if students have previous general computer experience or are computer-literate, they must have the necessary skills to use the Web for learning and that they will 'plod their way through' (Bembridge et al., 2011). Since WBL technology evolves so quickly, we cannot assume that students' confidence in using the Web for learning is all-encompassing.

When students use the Web for learning in blended learning settings, it is assumed that contact with peers and tutors is possible and students may receive social support from them. On the other hand, students who are studying online by themselves (self-directed setting) will not have access to support and encouragement from their peers.

Preparing students for Web-based learning is clearly important in ensuring that students gain the benefits from learning online either on their own or with others. However, it is essential that the preparation is effective and that students' confidence in using the Web for learning is maintained, in order that they have the capability to access other websites for learning purposes during the course and when they start or have returned to work in practice settings.

This study addresses these limitations by examining how students can be supported when undertaking Web-based learning with others or on their own. Accordingly, this study identifies the support needed and proposes a specific intervention as a mechanism for increasing student confidence levels to anchor their beliefs in their capability in using the Web for learning.

This study draws on the self-efficacy concept which stems from Social Cognitive Theory (Bandura, 1977) to determine the effects social support has on nurses' beliefs in their capability to use the Web for learning. As mentioned above, students learning in blended settings may gain support from their peers and tutors while those learning on their own in self-directed settings may not. Consequently, virtual persuasive agents are included in this research as informed by the media equation theory (Reeves and Nass, 1996). This theory holds that Computers are Social Actors (CASA) and that people respond to Web-based media as if they were social actors.

The central question explored in this study is the role of social persuasion (as one of the sources influencing self-efficacy beliefs) in supporting nursing students' subsequent self-efficacy in using the Web for learning. This study investigates if virtual peers (such as avatars, happy images and encouraging text) can provide

social support by adopting the CASA theory in one discipline (nurse education) as an intervention to increase Web-based learning self-efficacy (students' beliefs in being able to use the Web for learning). This study will explore the use of a bespoke Web-based training package which incorporates virtual peers as an intervention to change Web-based learning self-efficacy. This approach allows for the investigation of a possible longitudinal impact on students' beliefs in using the Web for learning.

This chapter sets the scene for this study. Since Web-based learning involves computer use, definitions of Web-based learning and related terms will be given to clarify the focus of this research (section 1.2). Given the relevance of previous computer use to this research, computer experience and how it impacts on Web-based learning will be covered (section 1.3). A brief overview of the self-efficacy theory and its potential use to measure computer, Internet and Web-based learning is given to distinguish how this concept informs this research (section 1.4). CASA is introduced as a framework used to inform the provision of virtual social support for students learning online on their own (section 1.5). The motivation for undertaking this study includes policy drivers for the importance of increased computer and Web-based learning efficacy in nurses (section 1.6). The research aims and scope and planned study design are given in section 1.7. Section 1.8 describes the significance of this research and contributions to WBL in nurse education. Finally, section 1.9 includes an outline of the remaining chapters of this thesis.

1.2 Definition of terms

To clarify the focus of this study, the term 'Web-based learning' needs to be defined to distinguish it from the terms 'computer use', 'Internet' and other applications of information and communication technology (ICT) in education such as e-learning, online learning and distance learning.

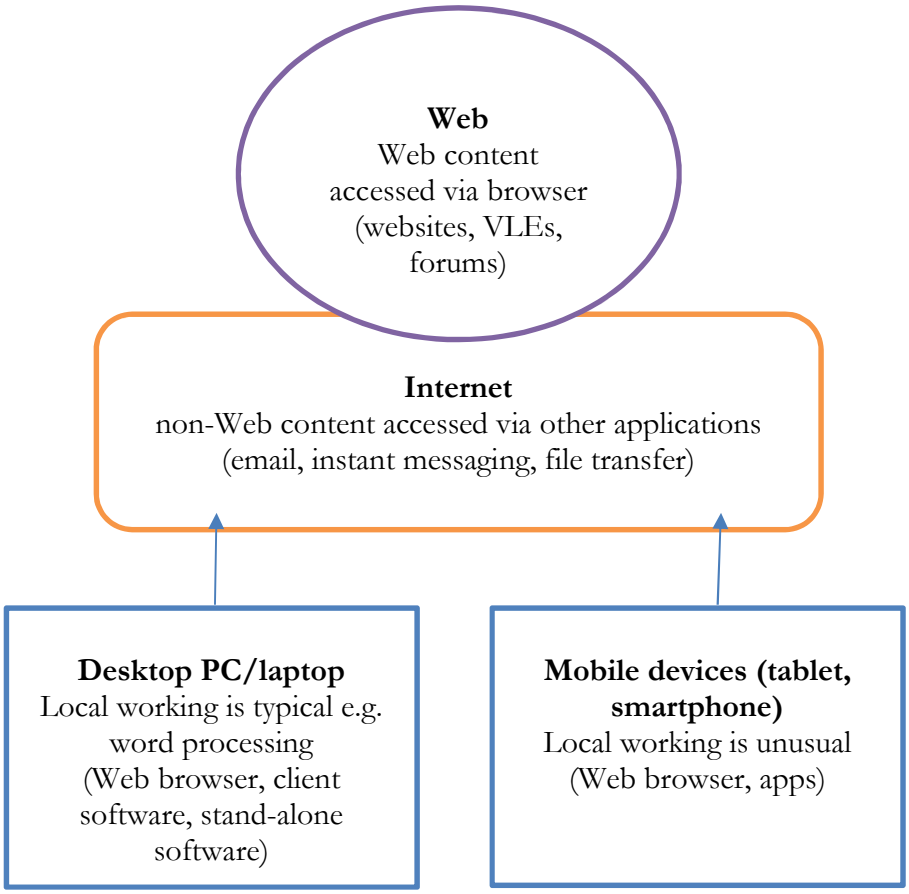


Figure 1. Relationship between computers, Internet and Web

The relationship between computers, the Internet and the World Wide Web is illustrated in Figure 1. It is argued that all ICT activities including Web-based learning are carried out on a computer. A computer is defined as a device (such as a desktop computer, laptop, tablet or smartphone) that accepts digitised information and manipulates it to provide results based on a program or sequence of instructions on how the data is to be processed. For a computer to be useful,

application software such as a word processor, database management system, Web browser or video player needs to be installed on the device. People use a broad range of software tools to achieve tasks specific to their goals. This implies that they have different levels of experience in using computers. Students who are familiar using a particular set of applications (such as a word processor) are not necessarily skilled in using others (such as database management system) (Nahm and Resnick, 2008). In addition, people use the same software applications for different purposes. For example, a student may be familiar with the basic tools of a word processor but may not have the skills to use the advanced functions such as mail merge or linking the application with other software, for instance with a bibliographic software.

The Internet is a networking infrastructure consisting of a massive network of networks (Internet Society, 2016). It connects millions of computers together globally, forming a network in which any computer can communicate with any other computer as long as they are both connected to the Internet. Information that travels over the Internet does so through a variety of languages known as protocols.

The World Wide Web, or simply Web, is a way of accessing information over the medium of the Internet (Berners-Lee et al., 1993). It is an information-sharing model that is built on top of the Internet. The Web uses the Hypertext Transfer Protocol (HTTP) protocol, one of the languages spoken over the Internet, to transmit data. Web documents are called Web pages that are linked to each other via hyperlinks. Web browsers, such as Internet Explorer, Chrome or Firefox, are used to access Web pages. Web pages may also contain graphics, audio, text and video.

The Web is a portion of the Internet. It is just one of the ways that information can be disseminated over the Internet. The Internet, not the Web, is also used for email, instant messaging and file transfer. The Web is just a portion of the Internet, albeit a large portion, but the two terms are not synonymous and should not be confused.

However, these terms do often get confused, particularly in literature reporting knowledge and skills needed for WBL. In this thesis, the term Web will be used to refer to using the Web for learning. Computer and Internet use, knowledge and skills will be used specifically when it is necessary to distinguish them from WBL.

Consequently, in this study, Web-based learning is defined as 'a course of study delivered via the World Wide Web where a website is set up specifically to allow students access to course materials, learning resources and assignments in an 'anytime/anyplace' learning environment' (Chumley-Jones, Dobbie and Alford, 2002). The delivery platforms for Web-based learning could be in the form of static or dynamic Web pages or through the use of specific virtual learning environment applications such as WebCT or Moodle (Moule, Ward and Lockyer, 2011). WBL is distinguished from the general term 'e-learning' which includes offline materials on CD-ROM and DVD and use of physical technological learning tools such as audience response clickers.

Students access a Web-based course not only from desktop computers but increasingly from portable devices such as laptops, tablets and smartphones. These devices deliver websites for learning on a variety of proprietary or open source Web browsers (such as Internet Explorer, Chrome, Safari and Firefox) which potentially require specific Web browser plug-ins and proprietary apps.

Web-based learning can either be delivered as part of a course students are enrolled in (blended learning) or at a distance (self-directed).

1.3 Previous computer use and Web-based learning experience

Given the above definitions, using 'computer use' as the starting point to define the purpose of this research would take the study too far. However, having recognised that students use computer applications for different purposes and with varying levels of skill, it is useful to reflect on their previous experience and how this may have an impact on their use of the Web for learning. Few studies have distinguished the differences (and overlap) between general computer use and using Web browsers to access learning materials. This makes it difficult to determine what are considered computer skills and how these overlap with Web browsing skills. One reason for this may be that WBL skills overlap with traditional computer literacy. For example, downloading a file is a common task associated with using the Web for learning but saving the document somewhere in a folder on the local drive requires file management skills.

Students who are more confident in their computer skills feel less anxious and are more likely to continue with online courses and to achieve better results (Osborn, 2001). Shih (2006) further suggested that previous computer experience significantly influences how students organise their online activities but not the quantity of work carried out. Participants with more experience in the use of Web tools organise their work online using less time and visiting fewer Web pages in each session.

The above studies seem to imply that if students had prior computer experience, they will have a positive experience in using the Web for learning. However, this is not always the case. Nahm and Resnick (2008) in their study with adults accessing Web-based health modules, suggested that the relationship between computer knowledge and confidence in using Web-based learning was significant, however, the correlation was low ($r=0.24$, $p<0.01$). This implies that experienced computer users are likely to have less difficulty but it may not guarantee the individual can utilise Web-based learning programs successfully.

1.4 Self-efficacy

Self-efficacy, which is a key factor in social cognitive theory, is defined as "beliefs in one's capabilities to organize and execute courses of action" (Bandura et al., 1977). It reflects the belief that individuals have about their ability to use WBL systems effectively. Prior research findings demonstrated that one's self-efficacy is an important factor for carrying out a certain behaviour or activity (Shu et al., 2011). Research studies suggest that the higher the level of self-efficacy, the greater is the performance achievement. Individuals with high self-efficacy work harder and longer than individuals with low self-efficacy.

Self-efficacy has been used to measure students' beliefs in their ability to use the computer, Internet and Web. As mentioned above, computer and Web skills have areas of overlap and the literature frequently includes Web skills in studies relating to computer and Internet skills. Hence, it is necessary to explore some of the literature on computer self-efficacy and Internet self-efficacy to clarify the focus of Web-based learning self-efficacy.

Computer self-efficacy (CSE) is defined as an individual's belief about his or her ability to use a computer to perform a computing task successfully. Research suggests that it plays a significant role in an individual's decision to use computers and how comfortable they are in learning computer skills (Compeau et al., 1999). Moreover, Marakas, Yi, and Johnson (1998) suggest that CSE affects not only a person's perceptions of his or her ability to perform a computing task, but also his or her intentions toward future use of computers.

Researchers have investigated the effects of CSE on computer use. Compeau and Higgins (1995b) reported that repeated use of the computer increased self-efficacy and lowered computer anxiety in adult individuals. Hasan (2003) examined the unique impact of computer experiences with specific types of applications (word processing, spreadsheets, databases, operating systems, graphics, computer games, telecommunications, and programming languages) on CSE beliefs. They found that experiences with all programs had positive correlation with CSE, however, experiences with programming and computer graphics applications have the strongest effects of CSE beliefs. This suggests that experience especially with respect to difficult and unfamiliar tasks represents the most significant determinant of self-efficacy beliefs. However, the study was only done with one sample. More empirical studies using diverse samples and additional computer experiences may be needed to generalise the results to other settings.

Internet self-efficacy (ISE) is considered an extension of the computer self-efficacy construct in the domain of the World Wide Web (Torkzadeh et al., 2006). ISE is defined as an individual's confidence in using the Internet (Tsai et al., 2011), and is regarded as an important predictor of attitudes toward Web-based professional

development (Kao, 2009). Learners with higher ISE may have more probability of success in Web-based learning tasks (Tsai and Tsai, 2003).

It has been reported that nurses reject web-based continuing learning because of their lack of relevant competence (Yu and Yang, 2006). Nurses with higher ISE, on the other hand, tend to reveal higher motivation for web-based continuing learning (Liang, 2010). Also, Liang et al. (2011) indicated that nurses' ISE is positively related to their attitudes toward web-based continuing learning.

It was suggested that students who use more sophisticated strategies and exhibit better performance in online information searching tasks usually have higher ISE (Joo et al., 2000 and Tsai and Tsai, 2003). For example, in Tsai and Tsai's study (2003), while students with high ISE often use a variety of keywords to search for relevant information, those with low ISE were reluctant to try other approaches when the keywords did not work. ISE indicates an individual's self-evaluated expectations and confidence in their skills of using the Internet and accomplishing Internet-related tasks (Chu and Chu, 2010, Kao, 2009, Liang and Tsai, 2008).

Web-based learning self-efficacy (WBLSE) is defined as an individual's belief in their ability to use the Web for learning. Cheng and Tsai (2011) proposed that WBLSE could be categorised into two components: general WBLSE and functional WBLSE. General WBLSE refers to a student's belief in his or her competence to complete online courses academically and functional WLBSE is the confidence in using relevant skills to enrol in and complete Web-based courses.

Given the above definitions of the different but related terms, it is imperative to explicitly state that this research concentrates on using the Web for learning, and

will explore the support requirements for students while they are 'learning online' as opposed to when they are 'on the computer'.

1.5 Computers as Social Actors (CASA)

As mentioned above, students accessing WBL in self-directed settings may not have access to peers to provide them with feedback and encouragement. The Computers as Social Actors (CASA) paradigm is proposed as a suitable framework to inform the potential of using virtual peers to provide social support in the absence of real peers.

The field of Human-Computer Interaction (HCI) has established that people often treat computers as social actors (Preece et al., 2002). The CASA theory posited that when interacting with computers, people treat computers as they would other people (Reeves and Nass, 1996). This suggests that the rules underpinning the interaction between human and computer somewhat mimics the social human-human interaction.

The CASA paradigm was expanded upon to suggest that computers can be perceived by users to have personalities similar to humans (Nass et al., 1995). Even small changes in computers' personalities can elicit social behaviours from their users (Lee, 2010). Additional research has observed that people can identify themselves as a "teammate" with computers (Nass et al., 1996) and can be flattered by computers, much like they would be with other people (Fogg and Nass, 1997). Numerous studies investigated the use of humanlike features into computers, agents, and robots in the aspect of language. This includes praise and

politeness (Nass and Moon, 2000) and how an interface's voice should sound (Lee, 2010, Nass, 2001).

The CASA theory and the implications of various types of computer interfaces in providing virtual support in the context of this research will be explored further in Chapter 2.

1.6 Research motivation

Web-based learning has been claimed to have the potential for developing '21st century skills'. These skills are argued as essential for all graduates entering the 'Knowledge Economy', and include digital literacy, creativity, flexibility and adaptability (HEFCE, 2009). An Online Learning Task Force (OLTF) established in 2009 by HEFCE, was given the important task to address how UK higher education "might maintain and extend its position as a world leader in online learning". The Task Force concluded that all delivery formats of online learning "provides real opportunity for UK institutions to develop responsive, engaging and interactive provision which, if offered at scale, can deliver quality and cost-effectiveness and meet student demands for flexible learning" (OLTF, 2011).

In nurse education, the key driving forces behind the increase in online learning delivery are the emphasis on continuing learning, the need for educational provision to be more flexible and responsive, and the need for the learning materials to keep pace with ongoing developments in research, technology and policy. In the UK, these dynamics are further reinforced by current government policies, for example the National Health Service Plan (NHS, 2016), The PREP handbook (NMC, 2011) and the Framework for Technology Enhanced Learning (Department of Health, 2011) which see continuing education as a major vehicle

for improving health services and health outcomes. Registered nurses in particular face an ongoing challenge of maintaining professional competence with the continuous influx of new knowledge and a rapidly changing health care system. Traditional nursing roles are expanding to cope with increasing numbers of people living with long term conditions, high profile public health concerns and advances in medical science and information technology (IT) (Presho, 2006).

With the advancement of educational technology and universal Internet access in recent years and as a means for responding to changes in government policies, nursing academia is exploring ways to widen nurses' educational opportunities and to facilitate 'on demand' education that matches individual student's needs. Web-based learning is assisted by a wide range of different Web technologies such as online discussion forums, podcasts and various interactive objects that provide educators with a range of useful new tools to assist them in delivering the high quality and flexible continuing education demanded by health service providers and health professionals (Song et al., 2004).

The motivation for conducting this research is partly informed by the above policy drivers. Nurses who trained prior to nurse education being transferred to higher education institutions may not have the necessary skills to utilise these Web-based courses (Childs et al., 2005, Sinclair and Gardner, 1999, Kenny, 2000). As a result, for many nurses learning a new technology in order to access continuing professional development may intensify the ongoing challenge of maintaining their professional competence.

Using the Web for learning involves more than having the skills needed to use the Web; it includes a variety of complex cognitive, motor, sociological and emotional

skills which learners need to use effectively in Web-based learning environments. Adult learners undertaking Web-based learning for the first time may be confronted with multiple challenges and steep learning curves that can impact significantly on their confidence and ability to succeed as a Web-based learner (Tyler-Smith, 2006, McVeigh, 2009).

More than a decade ago, it was reported that patients increasingly search online for information on various health conditions and ICT is regarded by experienced nurses as 'a tool of the trade' and a way to enhance the quality of patient care and reduce adverse events (Sandelowski, 2002).

> "Nurses look forward to a time when digital images of patient wounds will become routine components of nursing practice and computerized patient records, and when patients will be moved to greater participation in their own care because they are able to 'view their ulcers' on screen. In lieu of living patients per se, clinicians now treat 'bad strips.' Patients, in turn, look to images of the interior of their bodies to legitimatize their illnesses, to prove they are sick and to reassure themselves that they are well. They seek both information and 'solace' in cyberspace." (Sandelowski, 2002, p67).

The growth of ICT in modern patient care continues to change nursing functions and provides the potential and challenge for the expansion of the nursing role (Bath, 2008). Healthcare delivery increasingly relies on ICT for effective decision-making and care delivery (McNeil et al., 2005).

Internet and database use is prevalent in today's technological healthcare environment (for example the electronic patient record) and the enhancement of these skills through Web-based learning can make a potentially valuable

contribution to practice (Bond, 2007). Adams and Timmins (2006) argue that the enhancement of independent learning skills is especially relevant to post-registration nursing students since they are practising in a potentially unpredictable setting that demands independent thinking and problem solving. Reporting on a USA national survey (n = 2000), McCannon and O'Neal (2003) found that e-mail use, operating basic Windows applications and searching databases were the most crucial aspects of IT skills required by healthcare professionals. More recent studies reported that nurses used the Web mostly for data inputting or looking up patient information or test results (Thiel and Ghosh, 2008). Nursing students in particular need to have these transferable basic skills to inform their overall efficient and safe use of information technology in the workplace (Bembridge et al., 2011, van Deursen, 2012). It is, therefore, essential that students can transfer their Web searching skills into a work setting and that their confidence in using these skills in practice is long-lasting.

Given the nature of nurses' work schedules in practice, it is common that they may be carrying out online information searches for work purposes and studies on their own during less busy periods, for example during late night shifts (Bond, 2009). Hence it is important that they have the necessary skills and are confident in using the Web for learning in self-directed settings.

It is argued that nursing academia needs to support nurses who are new to WBL and to provide them with the knowledge and skills in using the Web to give them the confidence and belief in their capability in negotiating the technology. To achieve this, some kind of preparation prior to the start of a Web-based course may make a significant difference to a first time Web-based learner's perception and experience of online learning (Sinclair and Gardner, 1999, Cragg et al., 2004,

Morris-Docker et al., 2004, Wharrad et al., 2005). Examples of these are a handbook about using the Web-based environment (Cragg et al., 2004) or a blended approach of mixing person-to-person contact with IT methods (Tyler-Smith, 2006).

The other motivation for conducting this research was based on the researcher's local experience. In the School of Nursing where this study was undertaken, part of the researcher's role was to ensure that nursing students were able to access all the websites that they needed as part of their continuing professional development courses. This included a virtual learning environment (VLE) called WebCT. The VLE was intended to be the students' portal for all learning materials and course-related policies and documentation such as plagiarism guidelines and module timetables. The researcher was involved in developing module presence on the VLE and also delivering scheduled face-to-face training sessions to around 1400 post-registration nursing students on the first day of approximately 80 8-12 week continuing professional development (CPD) modules that ran throughout each academic year. Similar training sessions were also delivered to approximately 1000 pre-registration students at the beginning of an academic year. These training sessions aimed to resolve any login issues and to familiarise students with the VLE and other websites associated with their course. Previous studies reported that technical problems in accessing VLEs could cause anxiety in first-time adult Web-based learners (McVeigh, 2009, Cragg et al., 2004). Anecdotal feedback from novice and experienced Web-based learners was that they benefited from the training sessions. They felt reassured that they could access all the necessary websites they needed as part of their module. They also had the opportunity to use

these websites during the training sessions to look for information or to download course documentation such as a module handbook.

Whilst the initial training session was necessary to prepare students for using the necessary websites for learning, it was not clear that students gained confidence in using the Web for learning after the training. The students may have gained reassurance from the training facilitators and peers during the training, but may have still needed continuous support from their peers and tutors throughout their course. Post-registration students in particular generally undertake the CPD modules to accumulate credit points towards a degree or postgraduate qualification. Students who do not have the beliefs and confidence in using the Web for learning may return to do another module or course and participate in the initial training session again with the same feelings of anxiety in using the VLE and other associated websites. In addition, the time and resources taken to prepare and deliver the training sessions in this way are not economical for nurse education providers.

1.7 Research aims

The focus of this study is to investigate if virtual peers can provide social support in the absence of real peers in Web-based learning in a nurse education context.

The overarching aims for this study are:

1. To investigate if a short training session can increase nursing students' self-efficacy in using the Web for learning;

2. To explore if the presence of virtual peers such as avatars, images and text can compensate for the absence of real peers in improving Web-based learning self-efficacy in nursing students;

3. To examine if virtual peers of different fidelities provide social support in a similar way.

These aims will be discussed and placed into context following a review of the literature in Chapter 2.

1.7.1 Study design

The central feature of this study is to actively and deliberately introduce some form of change in nursing students' Web-based learning self-efficacy. Hence, an experimental design is planned. A bespoke online training package incorporating virtual social support will be used as an intervention to increase self-efficacy.

1.7.2 Setting boundaries

As mentioned above, this study will focus on Web-based learning. This study will not address general computer self-efficacy, attitudes to computers (although a short section is included to put this study into context), computer acceptance or satisfaction.

This study will focus on students accessing any aspect of WBL with their tutors and peers (blended setting) and on those who access any aspect of WBL on their own (self-directed setting). The study is not, however, concerned with the appropriate pedagogical use of WBL tools such as discussion forums in facilitating blended or self-directed learning.

1.8 Contributions to the field of Web-based learning in nurse education

The goal of the study is to inform stakeholders in HE and nurse education to more effectively recognise and address the need to support students who are not familiar with WBL to optimise the effort in developing and delivering learning materials online.

This research offers the following contributions to the field of Web-based learning in nurse education and practice:

- Contributes to the understanding of how nursing students can be prepared for Web-based learning through a brief training session.
- The development of training packages which can be adapted to change nursing students' Web-based learning self-efficacy.
- Contributes to the understanding of the role of social support in changing Web-based learning self-efficacy for students learning online with others or on their own.
- An evaluation of virtual persuasive agents in providing social support in the absence of real peers.
- Contributes to the understanding of how Web-based learning self-efficacy can benefit nurses to become safer practitioners.

1.9 Thesis outline

This thesis proceeds as follows:

- Chapter 2 provides a review of the literature on Web-based learning, a discussion on self-efficacy and the CASA theory in the context of Web-based learning. A brief history of nurse education is also provided to set the research context for this study.
- Chapter 3 describes the development of a bespoke training package called 'Succeeding at Web-based Learning'.
- Chapter 4 describes the study design and methodology.
- Chapter 5 describes the results of the studies.
- Chapter 6 discusses the results of the studies and the implications of the main findings on Web-based learning, nurse education and practice.
- Chapter 7 concludes, places the results of this study in the broader context of Web-based learning, nurse education and practice, and provides recommendations for further studies.

1.10 Conclusion

This chapter provided a general background on the motivation for undertaking this research. The next chapter will provide a review of the literature on Web-based learning in the context of nurse education and discuss the self-efficacy and CASA theoretical frameworks used to inform the objectives of this research.

Chapter 2: Literature Review – using virtual persuasive agents to provide social support for Web-based learning self-efficacy in nurse education

2.1 Introduction

This chapter presents a review of the literature on using virtual persuasive agents to provide social support for Web-based learning self-efficacy in nurse education (WBLSE). Nurse education is increasingly being delivered using online technologies. Consequently a review on Web-based learning (WBL) and how nurse education is utilising WBL approaches is included, identifying some of the drivers that led to this decision. Barriers to WBL in nurse education are explored, highlighting the support and training requirements of students learning in blended and self-directed settings. Given how pervasive computing is in all aspects of life, a section concerning students' WBL attitudes is included to distinguish the use of the Web for learning from general computer use attitudes.

It is argued that self-efficacy provides a useful framework for developing an intervention for improving nursing students' beliefs in their ability to use the Web for learning. The evidence reviewed in this chapter makes a link between Web-based learning self-efficacy and the social support that students need to be able to use the Web for learning. In doing this, the blended and self-directed delivery formats of Web-based learning are explored and the sources of self-efficacy, particularly social persuasion, for students learning in these settings are discussed. It is argued that the Computers as Social Actors (CASA) theory provides a useful framework that can be used to explore how virtual persuasive agents could potentially provide the social persuasion needed as part of an intervention to

change Web-based learning self-efficacy in self-directed settings in the absence of real peers. Finally, as many considerations need to be taken in order to design virtual persuasive agents, the literature that has explored these aspects is reviewed to provide the rationale for decisions taken in this thesis. The chapter will conclude by defining the specific objectives of the research study.

2.2 Search strategy used for literature review

The library databases used to explore the literature surrounding Web-based learning self-efficacy included Web of Knowledge, Web of Science, Zetoc, Science Direct, Scopus, Department of Health (DoH) and Cinahl. The main search terms used were nurse education, self-efficacy, web-based learning, e-learning, blended learning, online learning, self-directed learning, technology-enhanced learning, web-enhanced learning, distance learning, virtual learning, computer-mediated learning, computer attitudes, virtual agents and virtual actors. To limit the scope of the term 'e-learning,' the literature review focused specifically on online learning and Web-based learning. The previous terms were then used with other key terms such as "nurse education", "continuing professional development", "web-based learning self-efficacy", persuasive "virtual agents", "web-based learning" attitudes, web-based learning "drivers", "computers as social actors", CASA, "media equation", "computer attitudes", "computer self-efficacy", "computer literacy", "information and computer technology literacy", "ICT attitudes", "ICT knowledge and skills". More specific CASA terms used were avatar, "persuasive text", "happy images" and more specific self-efficacy terms searched for were "social persuasion", "social support", "mastery experience", "vicarious learning", "social modelling", "self-regulated learning", virtual "social persuasion", "computer self-efficacy", "Internet self-efficacy" and "web-based learning self-efficacy".

Relevant health research articles particularly were organised in a table highlighting research methods, strengths, limitations and results using the framework for critiquing health research developed by Caldwell et al. (2011). Relevant articles were also found through a non-systematic search, such as by using the reference lists of studies found through the systematic database searches, as well as broad, general searches using the search engine Google Scholar. Subscriptions to Rich Site Summary (RSS) feeds pushed latest articles from relevant journals and publications to an email inbox. Some of the journals subscribed to were Computers & Education, Computers in Human Behaviour, Journal of the Learning Sciences, Journal of Online Learning and Teaching, International Journal of Human-Computer Interaction and Nursing Education Today. Subscriptions to alerts such as Google alerts included latest relevant articles that cited seminal papers.

2.3 Web-based learning in nurse education

2.3.1 Web-based learning overview

Nurse education is increasingly using Web-based learning (WBL) approaches in delivering nurse education. An overview of WBL is necessary to position it in nurse education and to highlight some of the drivers that have led to this move.

The application of information and communication technology (ICT) in education has many references, for example online learning, distance learning (Moore, Dickson-Deane and Galyen, 2011), Internet-based learning (Berners-Lee, Cailliau, Pellow and Secret, 1993), Web-based learning (Narciss, Proske and Koerndle, 2007), virtual learning (Killion , Reilly and Gallagher-Lepak, 2011), and blended learning (Garrison and Kanuka, 2004). All are subsets of the broader term 'e-

learning' which is an all-encompassing term generally used to refer to computer-enhanced learning. E-learning may include a variety of online and offline delivery formats using a combination of different methods (Gilbert, 2007). Some examples are Web-based teaching materials, multimedia CD-ROMs or websites, discussion boards, collaborative software, e-mail, blogs, wikis, computer-aided assessment, educational animation, simulations, games, movies, video conferencing, smart boards, learning management software and more. This study concentrates on Web-based learning delivered on the Internet, specifically the World Wide Web (as defined in Chapter 1), as opposed to off-line learning delivery formats such as CD-ROM and static web pages.

Students access WBL in various ways and for different purposes. Web-based learning involves students navigating their course Web pages to fulfil goals such as searching for literature, downloading a podcast, playing a video clip, completing a quiz or posting a message to a forum (Masiello et al., 2005). They may also be accessing these online pages on various computer devices such as desktop or laptop computer, tablet or smartphone.

Using the Web for learning requires specific knowledge and skills: for example understanding the concept of downloading (and knowing where to find the file afterwards), bookmarking web pages, composing and posting a message online, and recovering from unexpected Web browsing events such as a broken link or a missing plug-in. These tasks may seem second nature to confident Web-based learners but may be daunting to novices. Students who are not familiar with WBL may feel disheartened and discouraged especially if support from peers or tutors is not readily available (Lahti et al., 2014).

2.3.2 Web-based learning delivery in blended and self-directed settings

Students can either access WBL on their own (self-directed) or with others (blended). In pure self-directed settings, for instance on online distance courses, students do not usually have face-to-face contact with their tutors and peers. These contacts are simulated and facilitated using appropriate Web-based tools such as a discussion forum for seminars, podcasts for lectures and online chat for tutorials (Mortera-Gutiérrez, 2006). Learning materials are carefully designed so that students can learn on their own.

In blended learning settings students access WBL with their peers. Generally, they also have face-to-face contact and teaching sessions with their tutors and have learning activities that they carry out on their own or with other students (Rovai and Jordan, 2004).

Many comparative studies have been conducted between blended learning or classroom environments and self-directed online learning (e.g. Anderson and Mercer (2004); Salamonson and Lantz (2005); Ellis et al. (2006); Hannay and Newvine (2006); Paechter (2010)) where the learning outcomes and satisfaction of students using various forms of Web-based technology were compared with those in classrooms. Typically, although students show readiness to engage in Web-based learning (Cragg, Edwards, Yue, Xin and Hui, 2003), they still prefer a blended learning environment where Web-based activities are supplementary to face-to-face teaching rather than replacing it (Koch, 2010, Lee et al., 2009). This suggests that although the students benefit from the anytime/anyplace advantage afforded by WBL, they still want the social aspect of classroom learning to be retained.

Support, particularly from online contact with peers and the instructor, is an essential feature (Washer , 2001; Childs, Blenkinsopp, Hall and Walton, 2005). Graff (2003) and Rovai & Jordan (2004) suggest that students engaging in online Web-based learning are missing the 'sense of classroom community' and the interaction that community members have. Comments such as 'I missed talking to other students' could imply that they feel that they may not be benefiting from the scaffolding effect of peer group support and a sense of belonging that blended learning environments can offer. Findings from the above studies suggest that peer support is a very important aspect of blended learning. Apart from the social support derived from peer interaction, students also benefit from learning with others in blended learning settings.

Nevertheless, the above comparative studies imply that the delivery of WBL is still largely developmental. It is, therefore, important to ensure that new Web-based learners are prepared for online learning.

2.3.3 Overview of pre-registration and post-registration nursing studies

A brief history of nurse education in the UK is presented to put this research study into context. Pre-registration and post-registration nursing studies are distinguished to highlight the similarities and differences between the two student groups and their learning environments in order to understand how they can be prepared for Web-based learning.

Nurse education is either undertaken at pre-registration or post-registration level. Qualification to become a nurse is attained by undertaking a pre-registration nurse training programme in a higher education institution. This course is generally

undertaken on a full-time basis. Post-registration nursing students are qualified nurses who have completed a pre-registration course either at diploma or degree level and obtained their nursing registration. In the UK, nurse training was traditionally carried out within a school of nursing based at the hospital site where the nursing students carried out their theory and practical ward work (Collister, 1990). Qualified nurses became State Registered Nurses or Registered General Nurses and were registered with the Nursing Midwifery Council (NMC). An alternative course was a shorter and more practical training programme which awarded the Enrolled Nurse qualification. Student nurses were on the ward rota and part of the ward team and workforce.

The introduction of the Project 2000 nursing curriculum (Slevin and Lavery, 1991) which aimed to establish nursing in a more professional light brought major changes to nurse education. It was felt that in order for nursing to be regarded as a serious profession, a more academic approach to training was needed. Nurse training was transferred into higher education, within a university setting. By 1996, the majority of former NHS schools and colleges of nursing and midwifery were integrated into higher education institutions. Nurses were encouraged to study to diploma or degree level. Enrolled nurse training stopped and colleges of nursing were no longer found within a hospital. Hospitals had to pay universities for the education and training of student nurses, and in turn the universities would provide nurses who were considered academically sound and 'fit for practice'. Further changes were introduced in pre-registration nurse education which required graduate entry into the nursing register from 2012 (NMC, 2010).

Completion of a pre-registration programme of nurse education does not mean that newly qualified nurses have all the knowledge and clinical skills they may be required to demonstrate during a lifetime of employment. The dynamic nature of health care demand, changes in systems of care delivery, advances in technology and changes in public expectations mean that nurses constantly need to revisit and revise their role. The PREP handbook (2011) required nurses, midwives and specialist community public health nurses to have completed a minimum of 450 hours of practice and to have undertaken at least 35 hours of continuing professional development (CPD) during the three years prior to renewal of registration. If registrants did not meet this requirement, they were expected to complete an approved return to practice course before registration can be renewed. CPD courses range from single study days to formal modular-based courses structured over a few months.

A new revalidation process replaced the PREP requirements from April 2016. The revalidation, or reconfirmation that nurses are fit to practise, serves to demonstrate that nurses practise safely and effectively. Previously, it was up to nurses to declare themselves fit to practise. Under the new system, nurses will face fitness-to-practise checks once every three years, involving feedback from patients, colleagues and employers on performance. The CPD requirement has been revised to include 20 hours of participatory learning (NMC, 2017).

Despite the pressure to meet NMC requirements, nurses are largely motivated to undertake CPD studies both for their own professional and personal development (Dowswell, Hewison and Hinds, 1998). They undertake CPD to be able to progress in their careers either to be promoted or as a move sideways into a new

area of work. On a personal level, nurses may want to catch up with their education either because they feel that they missed out or that they did not do well in earlier school life. Nurses who hold the old qualifications such as enrolled nurses feel under pressure to upgrade their qualifications so they are not overtaken by more academically qualified staff (Joyce and Cowman, 2007).

Post-registration students are more likely to accommodate study time during quieter night shifts on their own and at home while juggling demands from family life (Cooley, 2008). A large number of current registered nurses did not have the experience of learning in a higher education institution. So, in addition to the pressure of keeping their job, nurses who obtained their registration prior to Project 2000 may have the added challenge of not having previous exposure to WBL in schools or colleges. It is perhaps not surprising that they feel anxious about not being able to meet expectations in becoming part-time university undergraduate students, including learning new skills for accessing course materials and learning resources on the Web.

In addition, the entry gate into pre-registration nursing curricula is wide and there is currently no cut-off age for enrolling into pre-registration nursing courses. In the school of nursing recruitment report course (2006) where this research was conducted, over 60% of students were aged above 26 at the start of the course. This means that nursing students come from diverse backgrounds with varying degrees of WBL skills. Also, for registered nurses, having the necessary Web-based learning knowledge and skills is not just essential in preparing them to access Web-based CPD: they need these skills to give them the confidence to be able to manage electronic patient information systems on the wards to inform their

clinical judgment as well (Vezyridis, Timmons and Wharrad, 2011). It is therefore important that they are prepared for the expectations of higher education learning which involves WBL.

2.3.4 Drivers for Web-based learning in nurse education

Given the demographics of pre-registration and post-registration nursing students and the pressure for registered nurses to continue learning, it is essential that nurse education providers take steps to ensure that students are prepared in using the Web for learning. In order to determine how this can be done, it is useful to outline the reasons for delivering teaching and learning on the Web.

As mentioned in the previous section, the nursing curricula underwent major changes in the last decade. In the UK, these changes are implemented by the National Health Service (NHS) in conjunction with the nursing governing body, Nursing and Midwifery Council (NMC). Nurse education providers are responsible for ensuring that the delivery of the nursing curriculum meets the requirements and quality set by the NMC to ensure that student nurses are 'fit for practice' as registered nurses at the end of the course. The national learning strategy for the UK National Health Service 'Working Together – Learning Together: A Framework for Lifelong Learning for the NHS' (2001) identified online learning as a central strategic delivery mechanism for ensuring that nurse training is relevant for the purpose of "maintaining a well-developed, educated and competent workforce". This report was followed up by the 'Framework for Technology Enhanced Learning' which provides guidance to help nurse education providers to "deliver high quality, cost effective education, training and continuous

development to the workforce for the benefit of patients through the effective use of technology as part of a blended learning process" (DOH, 2011, p2).

Educational institutions respond to government guidance by structuring nursing curricula and incorporating quality measures to ensure that students achieve the required competencies for progression into nursing registration and continuing practice. As mentioned above, in order to stay on the NMC register, qualified nurses are required to undertake CPD studies for which they need to be allowed a certain amount of study time. Paradoxically, releasing them from work to meet this requirement is a challenge for most wards due to shortages in staffing resources. Nursing academia are encouraged to explore the delivery of nurse education on the Web not just for the pedagogical benefits of online learning and teaching, but also to exploit the more practical advantages of Web-based learning.

The most obvious benefit is that WBL overcomes physical distances. Teaching and learning can be facilitated in different geographical locations and time zones. For post-registration nursing students, Web-based learning makes CPD studies more accessible. Nurses are able to access WBL at any time or place including during quiet night shifts on the wards (Adams and Timmins, 2006). They can access learning materials and participate in asynchronous discussion groups at any time wherever they have Internet access. With personal mobile devices becoming more integral to students' daily lives, WBL access is more flexible and immediate. It makes education more accessible for students who cannot easily travel to universities (Adams and Timmins, 2006) and it is attractive to students who are independent and self-directed (Horiuchi, Yaju, Koyo, Sakyo and Nakayama, 2009). In addition, contact with tutors and peers can be facilitated through online chat

and forums, with the latter asynchronous mode of communication providing a continuity of tutor and peer presence.

Another practical benefit of WBL is the possibility for updating learning materials easily thus avoiding the costs of producing new versions of CD-ROMs or printed paper copies (Howatson-Jones, 2004). Feedback from students often prompts tutors to update their course structure and learning materials. Changes in nursing practice necessitate alterations in learning content. Unless the updates involve major curriculum changes, Web-based learning materials can be revised relatively easily and cheaply.

In addition, WBL offers the possibility of giving students greater control of their learning by allowing them to personalise their learning opportunities and to move at their own pace thus catering for varying degrees of student learning needs. WBL can also facilitate instructional methods that can be difficult to apply in traditional settings. In medical education, for instance, virtual patient simulators can provide medical students with a variety of patients and medical contexts to supplement classroom learning. In nurse education, virtual hospitals allow nursing students the experience to follow a patient journey, for example from accident and emergency admission, surgery to outpatients (Cook, 2006).

2.3.5 Preparing nursing students for Web-based learning

It is argued that nursing students who are new to online learning need to be supported to use the Web for learning in order to reap the benefits of learning in this way. The implications for not giving them WBL preparation may affect their performance in carrying out Web-based activities as part of achieving their course learning outcomes. For pre-registration students, this may result in failure in

attaining mandatory competencies and may impede their course progression. In addition, post-registration students have limited time to undertake CPD courses. It is, therefore, crucial for post-registration students to be provided with WBL preparation that is effective in giving them the long-lasting confidence in using the Web for learning throughout their career.

As mentioned in Section 2.3.2, WBL requires specific knowledge and skills that may be new to the student, for example familiarity with hyperlinks and knowing how to download online resources. Students need to be aware of the skills required and be familiarised with the online learning environment that they will be using. Lack of these specific skills causes students to feel anxious about starting a course which has WBL components. Students need to be able to identify their weaknesses in using the Web in order to be successful in undertaking Web-based courses and still persevere (Bond, 2010). For example, understanding that one can go from a Web page to another in a non-linear way by navigating the website menus may be a small performance or skill improvement for a first-time Web-based learner but it may produce a large increase in the student's confidence. In a blended learning environment, students can learn and practise these skills with support from their peers and tutors. In comparison, students trying to gain the essential WBL knowledge and skills in self-directed settings may not have these advantages.

Vicarious experience (learning by observing others learn) (Roberts, 2009) and social persuasion in blended environments can support students to contextualise their performance accomplishment within a specific Web-based learning task domain. For novice Web-based learners, succeeding in a challenging task (for

example participating in a group online discussion by posting a message with a hyperlink or file attachment to a discussion forum) gives them confidence that they have the capability to use the Web for learning. Preparing them for WBL helps them to personally relate the successful performance with what they need to achieve on the Web-based course, for example being an active contributor in an online discussion with their peers.

It is therefore essential that in supporting nursing students for Web-based learning that the barriers that prevent novice Web-based learners from effectively and confidently learning online are removed. More importantly, students require peer support throughout their Web-based course to prevent the feeling of social isolation and anxiety and to provide them with a sense of community and source of encouragement. The same studies (Kenny, 2000, Washer, 2001, Reilly et al, 2012) which reported these barriers recommended that a pre-course training or preparation is provided to prepare first-time Web learners in order to give them an idea of what to expect, what skills are needed and to give them the opportunity to make a judgement of their own capability to use the Web in order to succeed on a Web-based course. More recent studies (Nwezeh, 2010, Killion et al., 2011) also advocate that some kind of training is needed to prepare students for WBL, for example in the form of 'demonstration' for online courses and 'application' for off-line modules need to be considered.

In Stokes' (2000) study in preparing students to take an online interactive graduate course, students worked on the pre-course materials on their own and identified weaknesses in the knowledge and skills (following links in a Web page, bookmarking and downloading) that they needed to undertake the course. This

gave students the opportunity to identify their weaknesses in using the Web in order to be successful in courses offered through this medium. In addition, a dedicated training session separated learner-users from the immediate pressure of the extrinsic goals and pressures of their course for a short period of time (Draper, 1999). After a short training, students who initially expressed concerns about WBL because of their limited familiarity with computers ('not knowing what to expect'; 'not as scary as I thought') became active participants (Song, Singleton, Hill and Koh, 2004).

For students to benefit fully from the advantages of WBL, it is important that they have the appropriate support and have the confidence to use the Web for learning, particularly when studying on their own. This combination of WBL pre-requisites constitutes a student's self-efficacy in using the Web for learning.

In the light of the above discussion, it is clear that nurse educators have the responsibility to ensure that online theoretical and clinical skills learning is delivered not just to ensure that it is fit for purpose, but also to ensure that students are given the necessary support to anchor and increase their self-efficacy in using the Web for learning. Having the appropriate support in place may have direct impact on their academic performance and ability to perform clinical skills safely which enables them to deliver safe patient care.

2.3.6 Nursing students' attitudes to computers and Web-based learning

In order to investigate how student nurses could be prepared for Web-based learning, it is important to understand their attitudes to using the computer for accessing the Web for learning.

As discussed in Chapter 1, computer use and WBL overlap but they are not synonymous. The computer attitudes concept has not been given a unique definition despite the numerous studies conducted on general computer attitudes. Moreover, the word 'computers' itself is used in the literature as an all-encompassing term to involve every activity that uses a computer (Popovich, Gullekson, Morris and Morse, 2008). As mentioned in the previous section, students need to know specific skills in order to use the Web for learning. Although a computer is needed to access the Web for learning, in today's digital world, this could mean accessing a virtual learning environment through a Web browser on a desktop computer or participating in a webinar from a tablet device or listening to a podcast on a smartphone. The way in which a student downloads a digital learning resource is determined by the static or mobile device they have. However, the WBL fundamental concept of downloading, which is a specific WBL skill, is independent of Web browsers or computer devices. Hence for the purpose of this study, the discussion on attitudes will be focussed on the specific usage of the computer which is using the Web for learning.

Sáinz and López-Sáez (2010) in their study on gender differences in computer attitudes and the choice of technology-related occupations suggested that computer attitudes have three elements: stereotypes or beliefs about computers, computer comfort and enjoyment, and frequency of computer use. In other words, an attitude can be defined as a positive or negative evaluation of people, objects, event, activities, ideas, or just about anything in one's environment. Attitudes can be formed from a person's past or present experiences. In this respect a person's strengths of beliefs in their capability to use the computer to access Web-based learning resources may have been influenced by their past

experiences (of success or failure) or observation of people around them (Bandura, 2002). This implies that individuals' beliefs about computers influence their enjoyment or endurance of carrying out a task using a computer.

Students' computer or WBL attitudes are also generally described as satisfaction (Bynum et al., 2010), acceptance (Hu et al., 2003) or anxiety (Wilfong, 2006). However, studies show that students use computers for very specific purposes depending on the courses in which they are enrolled which may influence their computer attitudes. For example, in the study on ICT use with primary school teachers, Tezci (2009) found that the most commonly used and well-known ICT technologies among teachers were the Internet, e-mail and word processing. Even though teachers' attitudes towards computers and the Internet were generally positive, it was also found that their attitudes varied with their years of experience and levels of knowledge. Beckers, Rickers and Schmidt (2006) conducted a study to test the hypothesis whether computer anxiety has a hindering effect on experienced computer users (psychology students taking a Delphi programming course) while performing complex computer tasks. Their findings showed that whilst computer anxiety was found to correlate with the students' prediction of their final grade and with the perception of their own computer skills, it had no effect on actual performance as measured by the final course grade. They concluded that anxiety only hinders performance when this anxiety is sufficiently severe or when the context in which the task to be executed on a computer is ambiguous.

In the context of nurse education, the literature reported that nurses generally are willing to use computers to access information. For instance, 97% (n=1708) of the

nurses in the study conducted by Webster, Davis, Holt, Stallan, New and Yegdich (2003) agreed that computers improved access to information and an encouraging 91% agreed that all nurses should know how to use a computer. This view is echoed in the academic setting. Sinclair and Gardner (1999) in their study on attitudes of pre-registration nurses to computers found that the majority of students were satisfied and felt positive in using the Web for learning although the students' computer knowledge varied considerably. However, this may not be representative of other course provision or learning needs. The main disadvantage of WBL is the feeling of social isolation (Adams and Timmins, 2006). Flexibility in time and location means that the online learner could often be studying alone. This implies that whilst WBL increases learner access and flexibility of educational delivery, it may also be the key deterrent to learning for novice Web-based learners. Post-registration nursing students in particular are most likely to access Web-based CPD courses for short periods in blended or self-directed settings. It could be argued that peer support and encouragement is a vital feature in helping them to succeed as Web-based learners. Nursing students are never learning 'alone' in practice – in addition to course peers, they are generally part of a tripartite learning team consisting of the student, their tutor and their mentor in practice. Nurses learning online on their own in particular may not benefit from the scaffolding effect that peer group support, face-to-face tutor contact and a sense of belonging that learning in an institution can offer (Rovai and Jordan, 2004).

As discussed earlier, pre-registration and post-registration nursing students come from widely differing educational and experiential backgrounds and, as a result, have different levels of computer knowledge. Nurses who trained prior to the

transfer of nurse education to higher education institutions may be at risk of failing academically as they may lack the skill to plan and manage their own learning online (Sinclair and Gardner, 1999). Although it is encouraging that nursing students now largely have access to the Internet (Bond, 2010), not all students feel confident with ICT and using the Web for learning. Nurses are expected to be self-directed adult learners, critical thinkers and to apply evidence-based practice. Learning new WBL skills in addition to offline self-directed learning expectations may be daunting for novice Web-based learners. Whilst WBL has the potential to deliver personalised learning goals which enable students to adapt WBL to meet their learning needs and outcomes, using the Web to deliver learning in this way is still experimental. From the student's point of view, WBL can also take up personal time which could be daunting for a novice Web-based learner who is not used to learning in this way (Cook, 2007).

Lack of computer skills, erroneous perceptions of course workload and inadequate preparation for Web learning are largely responsible for the majority of withdrawals. Atack's (2003) study also found that 25% out of 57 registered nurses who enrolled did not in fact start the course. There is little evidence of this non-starter phenomenon in the literature and further study is warranted although anecdotal evidence suggests that this is not uncommon in Web-based courses. Levy (2007) and Tyler-Smith (2006) reported that dropout rates from e-learning courses were documented at around 25-40% as compared to 10-20% in on-campus courses.

In addition to the feeling of social isolation and the need to learn specific WBL skills, previous studies also reported a general mixed perception by nurses that

computer use detracts from patient care. Although outright refusal to use the electronic systems is not evident, studies on the use of computers in clinical settings revealed that there is a degree of resistance amongst nurses in using the systems (Darbyshire, 2004, Timmons, 2003). In both clinical and academic settings, nurses have no choice but to use the technology imposed upon them. Timmons (2003) described this phenomenon in his study on the use of computerised care plans in a hospital by nurses as 'resistive compliance', where resistance was displayed as attempts to minimise or 'put off' use of the systems. It may be that 'bad' experiences of computer systems in clinical practice prejudice the use of computers for learning and continuing professional development. Darbyshire (2004) in his study on the use of computerised patient information systems found that nurses' and midwives' 'rage against the machine' was a direct result of policy and decision makers' and developers' scant regard for the end-users.

In this context, nurses are no different from the typical end users of any online system including virtual learning environments (VLE) such as WebCT or Moodle in academic settings. There is little evidence that potential users of a Web-based learning environment are consulted before a module or a course is developed online. Typically in large higher education institutions, a corporate virtual learning environment will already be in existence when students start their course. This implies that novice WBL learners could be starting the course 'cold' with no preparation, resulting in misperception and a fearful experience, or at worst withdrawal from the course (Tyler-Smith, 2006). Students will have to 'learn' to use the WBL learning environment simultaneously with pursuing their educational learning goals for which the learning environment is only a means to an end. This

implies that students may benefit from a familiarisation of the websites that they need to use as part of preparing them for Web-based learning.

As discussed above, nursing students, particularly post-registration students, have limited time to achieve their learning goals and even less time to learn how to use the relevant websites as part of their course. These 'learner-users' (Guzdial, 1999) will have particularly large goal hierarchies because their top level goals are related to passing a course, and even the highest goals associated with accessing the Web-based learning environment (such as downloading a module timetable) are already a significant distance down the stack. This additional simultaneous learning burden would particularly affect post-registration students who are undertaking new CPD educational goals as a requirement for staying in employment. It may mean that they would only attempt to use the VLE in response to an immediate larger goal (for example meeting a deadline for an assignment) for which the system is a means to an end. In this respect, they are typical of most Web users, in that they are intrinsically impatient and under pressure from extrinsic goals (Joo, Bong and Choi, 2000).

2.4 Self-efficacy

2.4.1 Overview of self-efficacy

The concept of self-efficacy originates from Social Cognitive Theory (SCT), which is based on the idea that people learn by watching what others do or don't do. It is argued that the observation process is influenced by their environment, behaviour and cognition. The three factors are reciprocal in that each behaviour witnessed can change a person's way of thinking. The environment a person is raised in may influence later behaviour. The cognitive factor is further defined into efficacy and

outcome expectations. In SCT, learning is viewed as acquiring knowledge through cognitive processing of information. In other words, the social part is what individuals learn from being part of a society, whereas the cognitive portion is how individuals' thought processes influence motivation, attitudes and action (Stajkovic and Luthans, 1998).

The self-efficacy concept deals specifically with how people's beliefs or confidence in their capabilities to pull together their motivation, cognitive resources and course of action needed, to successfully carry out a task within a given context. It is concerned not with the skills one has but the judgments of what one can do with whatever skills one possesses (Bandura, 2002). In other words, self-efficacy is seen as a person's belief in his or her ability to succeed in a particular situation. An individual's belief or confidence for coordinating and carrying out a specific action in accomplishing a task or a goal influences whether a specific action is taken. Consequently, whether people will make an effort to handle given situations depends on the strength of their effectiveness beliefs.

Proponents of self-efficacy assert that people choose different courses of action depending upon the strength of their effectiveness beliefs (Bandura, 1977, Strecher et al., 1986, Zimmerman, 2000). People who have a strong sense of self-efficacy view challenging problems as tasks to be mastered. They develop a deeper interest in the activities in which they participate. They form a stronger sense of commitment to their interests and activities and recover quickly from setbacks and disappointments. In contrast, people who have a weak sense of self-efficacy avoid challenging tasks and believe that difficult tasks and situations are beyond their capabilities. They tend to focus on personal failings and negative outcomes and hence quickly lose confidence in their personal abilities. For example, taking this

perspective it might be argued that the difference in how some novice Web-based learners undertake Web-based learning tasks is due (partly) to their self-efficacy. Those who more readily undertake tasks would have high self-efficacy and while others who may seem resistant and convinced of failures before beginning have low self-efficacy. Their confidence is independent of whether the individuals have the skills and abilities to perform particular tasks with computers or using the Web for learning.

Self-efficacy judgments are specific to behaviours and the situations in which they occur. People are motivated to perform behaviours they believe will produce desired outcomes whereas an efficacy belief concerns one's capability to produce the behaviour. Individuals can believe a behaviour will lead to desired outcomes and yet have no confidence that they personally can perform the required behaviour (Bandura and Locke, 2003). In the context of this research, an example desired outcome could be student participation in an online group discussion: the novice Web-based learner can believe that accessing the relevant Web-based learning system can lead to the desired outcome, but he or she may not be confident that they know or are able to go through the preceding steps of actually getting to the online forum itself before posting a message. The steps could include logging on to a computer, opening a browser, typing the Web address for the WBL system into the browser address bar (or finding it from the list of bookmarks or if it was sent in an email message, taking the steps needed to retrieve it), logging on to the WBL system and locating the correct forum. An unexpected event could happen at any stage of the process to get to the forum, such as a mistyped password or an extra plug-in (such as Java) requiring

installation for the forum to run. For a student with low self-efficacy, the task of posting a forum message could be too challenging and is a reason for giving up.

2.4.1.1 Related theories

In order to ascertain that self-efficacy is the appropriate framework to use in this research, it is important to distinguish the concept from others. This can be done by defining its attributes (Robb, 2012). As discussed above, individuals with high levels of self-efficacy have strong personal beliefs that they can master a particular activity, have perceived ability that they can demonstrate the required behaviour to achieve goals, and have the ability to successfully cope with stress and environmental stimuli. Therefore, the defining attributes of self-efficacy include confidence, perceived capability, and perseverance (Bandura, 1982a).

On the other hand, related concepts are terms that show a relationship to self-efficacy but have a different set of defining attributes. Self-efficacy has most often been connected to, and often confused with, the terms self-esteem and self-confidence. Self-esteem is a related concept but it refers to a general feeling of self-worth or self-value; a "realistic respect for a favourable impression of oneself" (Merriam-Webster's Online Dictionary, 2007). In contrast, self-efficacy is concerned not with the global perspective of what a person thinks about oneself but rather about the perception or judgment of being able to accomplish a specific goal in a specific domain, for example Web-based learning. Self-esteem and self-efficacy have been used together as predictors of student attrition from courses (Peterson-Graziose et al., 2013) and for overall academic performance (Zuffianò et al., 2013) which served to highlight their differences. Students who have high self-esteem tend to have high motivation for completing a course (they try to excel on

the course in order to maintain a positive image of themselves) but they do not necessarily have the self-efficacy in meeting specific course requirements.

Self-confidence is the belief that "one knows how to do something and has the ability to make things happen" (Ferguson, 1996) whereas self-efficacy deals with the strength of this belief in his or her ability to succeed. The concept of confidence as defined by Bandura (1982a) is the "perception that one is competent and capable of fulfilling particular expectations," such as being capable of meeting the expectations of a particular role. Self-confidence is defined as "confidence in oneself or one's own abilities" (Merriam-Webster's Online Dictionary, 2007). It is a learned concept that develops over time through continual reinforcement of positive behaviours (Brown et al., 2003). These three concepts although overlapping in meaning, clearly have different attributes. Given that the focus of this research is on the specific domain of students' beliefs in using the Web for learning, self-efficacy was deemed to be the appropriate framework to use.

2.4.2 Sources of self-efficacy

Bandura (1982b) suggests that people's beliefs concerning their self-efficacy can be developed by four types of influence:

- social persuasion or verbal persuasion
- vicarious experience or social modelling
- performance accomplishments or mastery experiences
- physiological and emotional states

These four sources of self-efficacy are explored below in the context of Web-based learning and the interplay between social persuasion and the other sources of self-efficacy.

a) Social persuasion or verbal persuasion

Social persuasion (feedback and encouragement) by someone the student trusts and sees as competent (as it relates to the task to be performed) serves as an important means of strengthening personal self-efficacy. It is argued that the purpose of verbal persuasion is not necessarily to increase the level of skill or ability, but rather to focus on the individual's appraisal of self-efficacy so as to enhance the person's beliefs that he or she 'has what it takes' to perform a specific task (Bandura, 1982b). However, for social persuasion to be effective, students should already have some reason to believe that they have (or can develop) the knowledge and skills to accomplish the task. Expressing faith in a student's ability is particularly relevant in times when students have performance difficulties and may be questioning their personal efficaciousness.

For example, a student who already had a successful experience in downloading a document from a website encounters problems playing a downloaded video clip because the associated software to play it is missing. Students with high self-efficacy may think "I'm missing something but it's not me" whereas students with low self-efficacy may think "I can't do this, it's beyond me". Having peers or experts around who can give the student encouragement may raise their belief in their own capability in that just by doing one or two extra steps (for example, downloading and installing the correct player for the movie clip) they can achieve their goal (in this case, watch the video clip). Accordingly, this particular source of self-efficacy is difficult if not impossible to 'generate' without the essential social ingredient: the presence of people who can provide support for the accomplishment of a specific WBL task such as downloading a file. Students with low self-efficacy levels who are undertaking Web-based courses without face-to-

face support may not benefit from this social persuasion element. Hence, they may struggle to cope with a Web-based course. Self-efficacy may increase given mastery and vicarious experiences as explained below, but without social persuasion, the increase may not be long-lasting and may decrease over time if support is not provided. This implies that in preparing student nurses for WBL, this aspect of self-efficacy must be included in any intended intervention.

b) Vicarious experience

In observing others carry out specific tasks, individuals may judge their capabilities against those of others. Since much of adult learners' knowledge about their capabilities is also generated from the social environment in which they work, to rely solely on mastery experiences would limit the sources for accurate efficacy appraisals. Seeing people similar to themselves succeed by perseverant effort raises and reinforces their beliefs that they too have the capabilities to master comparable activities (Wang and Wu, 2008).

For example, looking something up on a website could be done by using the 'search' facility or using the website navigation menu. Watching a colleague search for information using these methods and succeed (or fail) allows the learner to benchmark his/her own capability against that of his/her colleague. Students accessing WBL in blended settings will benefit from colleagues' experiences. Conversely, learners studying in isolation 'at their computer' may be missing these vicarious experiences.

c) Performance accomplishments or mastery experiences

Research has indicated that succeeding in a challenging task (termed 'enactive mastery experience') provides the strongest information for changing efficacy beliefs. However, this still needs to work in conjunction with vicarious experience and social persuasion. This is because enactive mastery provides the student with direct feedback on their performance to form a more stable and accurate judgement on their ability to perform a similar challenging task again. This does not mean, however, that changes in self-efficacy occur as a direct result of performance accomplishment. Rather, change will depend on how students process the information from the previous successful (or unsuccessful) performance. In other words, it is not performance per se that causes changes in self-efficacy, but rather what the student personally makes of the indicative information resulting from that performance (Fields, 2005).

For example, understanding that one can go from a Web page to another by clicking on hyperlinks may be a small performance/skill improvement for a first-time Web-based learner but it can produce a large increase in the student's self-efficacy if he/she evaluates the performance in a way that confirms the feeling that they are 'up to it' and 'have what it takes' to succeed.

In order to experience mastery of a particular task, the student needs to know how to accomplish it. For instance, the task of downloading a file requires practical knowledge and skills which include understanding the concept of 'downloading', knowing what file formats can be downloaded (not everything on the web can be downloaded), knowing the various ways of downloading (right clicking on a mouse or clicking on a text or image link) and saving it to a known location on a

computer for later retrieval. All these can be learned by watching others go through the process (either a demonstration by a real person or a video recording of the multiple steps or by following written instructions). Again depending on how the student judges his or her self-efficacy level, he or she may understand the concept of downloading and identifies the file that needs to be downloaded but may then ask a more confident colleague or family member to perform the task of downloading the file for them.

It has been found that perceived task ability significantly affects performance (Torkzadeh and Van Dyke, 2002). Individuals with moderate to high self-efficacy tend to engage more frequently in task-related activities and persist longer in coping efforts. This leads to more mastery experiences, which in turn enhance self-efficacy. Those with low self-efficacy tend to engage in fewer challenging efforts; they give up more easily under adversity and manifest less mastery, which in turn reinforces their low self-efficacy (Bandura, Adams and Beyer, 1977).

d) Physiological and emotional states

People rely on their physiological and emotional states in judging their capabilities. They interpret their stress reactions and tension as signs of vulnerability to poor performance. In activities involving strength and stamina, people judge their fatigue, aches and pains as signs of physical debility (Ewart, 1992). Mood also affects people's judgements of their personal efficacy. A positive mood enhances self-efficacy; a despondent mood diminishes it. Web-based learning designers need to ensure that the online learning environment does not cause unnecessary stress and negative perceptions by reducing the likelihood of students encountering failure in the exercises. In preparing nurses for WBL, any intervention needs to

ensure that any technical problems (for instance password issues) have been resolved beforehand. Other studies have found that technical problems contribute to unnecessary stress for the students even before they access WBL (Adams and Timmins, 2006).

2.4.3 Use of the Self-Efficacy Theory

A plethora of studies have examined how self-efficacy influenced individuals' performance in carrying out specific tasks and the courses of action to achieve them. In view of the focus of this research, this review concentrates particularly on the domains of health and education.

Self-efficacy has been studied extensively in the health promotion and health behaviour choices, for example, in lifestyle and health behaviour changes with smoking (Luzzo et al., 1999), exercise (Chase, 2001) and weight reduction (Strecher et al., 1986). Chen et al. (2002) administered the Smoking Self-Efficacy survey to 401 children aged 11-14 years to investigate if there was a relationship between low self-efficacy and resistance to the temptation to smoke. They found that the non-smokers (75%) had higher self-efficacy scores than the experimental (18%) or the regular smokers (8%) and the experimental smokers scored higher than the regular smokers. Influence from friends (negative social persuasion and vicarious experience) and emotional stress were amongst the factors contributing to the children's low resistance to smoking. In the case of physical exercise self-efficacy, (Allison et al., 1999) found social strain (peer pressure) to be positively related to participation in vigorous physical activity in physical education classes. The degree of self-efficacy individuals had in their ability to perform the behaviour change predicted the outcome of goal attainment. Conversely, negative

relationships have been identified between self-efficacy and caregiver roles. Research by Salonen et al. (2011) evaluated parents' self-efficacy levels regarding parenting after childbirth. Parents with low levels of self-efficacy required emotional support to decrease their fears and anxieties, before they could demonstrate the appropriate caregiver behaviours. These studies indicate that social persuasion and psychological states influence self-efficacy, both in increasing and decreasing it.

In relation to academic and learning performance, researchers examined how self-efficacy influences learning (Fall and McLeod, 2001, Lane et al., 2004). At the start of an activity, students hold differing beliefs about their capabilities to acquire knowledge, perform skills, master the material and so on. Initial self-efficacy varies according to their abilities, attitudes and prior experiences. Personal factors such as goal setting, information processing and situational factors (e.g. rewards and teacher feedback) affect students while they are learning. From these factors, students make a judgement on how well they are learning, which they use to assess efficacy for further learning. Motivation is enhanced if students perceive they are making progress in learning. In turn, it was found that as students work on tasks and become more skilful, they maintain a sense of self-efficacy for performing well (Schunk and Swartz, 1993).

The nursing literature has established a link between self-efficacy and acquisition of clinical skills and suggests that increasing students' self-efficacy will help to narrow the theory–practice gap (Kuiper and Zabriskie, 2012). Use of clinical simulation (a teaching and learning strategy that aims to replicate real-life experiences) has been noted in nursing education literature to increase self-efficacy

and knowledge attainment. Sinclair and Ferguson (2009) propose that integrating simulation activities in the classroom environment increases self-efficacy for nursing practice. Similarly, Clark et al. (2004), in their study on nursing students' self-efficacy levels relationship with clinical skills performance found that students with low levels of self-efficacy required emotional and academic support to meet their learning needs before they could demonstrate clinical skill competence. Docherty et al. (2005) explored supporting problem-based learning (PBL) in clinical simulation using high quality learning objects embedded within web pages which substituted lecturers providing instruction and demonstration. They found that this encouraged student nurses to explore, analyse and make decisions within the safety of a clinical simulation. Learning was facilitated through online communications and reflection on video clips of their own performances and those of others. Evaluations from students were positive and students demonstrated increased satisfaction with PBL, improved performance in exams, and increased self-efficacy in the performance of nursing activities. These results suggest that WBL can help students acquire clinical skills in the safety of a simulated environment within the context of a PBL curriculum, thus increasing self-efficacy.

2.5 Web-based learning self-efficacy (WBLSE) intervention

As discussed in section 2.3.5, any intervention for WBLSE needs to consider the sources of self-efficacy in both self-directed and blended learning settings. Social cognitive theory emphasises that in addition to personal factors such as information processing, situational factors greatly affect students' self-efficacy while they are learning (Bandura, 1982b). In blended setting, working together or

observing peers (vicarious experiences) in accomplishing tasks on the Web reinforces students' beliefs that they, too, can master comparable activities. Social persuasion in the form of feedback and encouragement from tutors or training instructors enhances the learner's beliefs that he or she has 'what it takes' to succeed in a Web-based course. Consequently, this study will explore if the presence of social persuasion has an impact on WBLSE in both self-directed and blended learning settings.

The self-efficacy theory further argues that the real ingredient for generating social support is actual peers who could provide verbal encouragement and support. Students learning in blended and traditional classroom environments benefit from the social interaction and vicarious learning experience with peers and tutors. In comparison, students learning by self-directed Web-based learning cannot benefit from these advantages and may feel isolated (Domagk and Niegemann, 2005) and social persuasion needs to be compensated for. Accordingly, this research explores compensating real peers with virtual persuasive agents.

Virtual persuasive agents are explored further in this section to understand how they may provide social persuasion for Web-based learners. In this study, virtual persuasive agents are referred to solely in their role in providing social support to 'persuade' novice Web-based learners that they have the capability to use the Web for learning.

Virtual persuasive agents are also called social agents, social actors or virtual peers. These terms will be used interchangeably in this research. Social agents are differentiated from pedagogical agents or instructional agents which are used to convey instructions and facilitate learning.

2.5.1 Computers as Social Actors (CASA)

In order to understand if social persuasion can impact on WBLSE, it is important to understand how virtual persuasive agents afford social persuasion through the Web interface or from the computer screen. The Computers are Social Actors (CASA) theory (Reeves and Nass, 1996) holds that people respond to Web-based media as if they were social actors. CASA argues that the social rules that guide human-human interaction apply equally to human-computer interaction. Few studies have explored this concept in relation to the provision of social persuasion in WBL self-directed settings. In addition, no relevant studies have been found in the field of nurse education. Hence, it is necessary for this section to review literature from other areas.

Social exchanges with computers exist across the spectrum of electronic technologies. Social presence is defined as "the degree of awareness of another person in an interaction and the consequent appreciation of an interpersonal relationship" (Hassanein and Head, 2007, p689). Social presence through a Web interface refers to the individual's degree of feeling, perception or reaction of "being connected to another intellectual entity, which involves a subjective quality of the communication medium related to the concepts of intimacy and immediacy" (Tu and McIsaac, 2002, p252). In other words, a medium which provides people with intimate or immediate responses may evoke their social emotional reactions. Such experiences could allow an individual to perceive that another social being exists and is interacting with them (Tung and Deng, 2007). This implies that the Web interface is a powerful mechanism for inducing social responses from people.

People's attitudes can be influenced by the social attributes of computers and their social response can facilitate a more intimate human-to-computer interaction. This in turn improves the users' attitudes towards computers and motivates them to interact with computers. Individuals apply a wide range of social rules and behaviours that change their interactions with and attitudes towards computers. For example, people consider a website 'user-friendly', pleasant and attractive when they had a positive experience in using it. A website that welcomes a user by name (such as the Amazon online market) makes the user feel that the website 'knows' them personally. It promotes familiarity and trust (Gefen, 2000). In contrast, users feel frustrated and angry if the website makes it difficult for them to find what they are looking for or if certain aspects of the Web interface irritate them. Websites which are 'pushy', such as those that use blinking icons, repeating audio or pop-up messages to attract the user's attention, may cause the user to abandon his or her intended goal of visiting the website; and worse, may not use the website again (Abras, Maloney-Krichmar and Preece, 2004).

Social behaviours from a virtual peer can lead people to infer, often subconsciously, that it has feelings, preferences, motivations and personality. People respond "mindlessly to computers to the extent that they apply social scripts - scripts for human-human interaction - essentially ignoring the cues that reveal the asocial nature of a computer" (Nass and Moon, 2000, p83). This suggests that the social rules that guide human-human interaction apply equally to human-computer interaction. Studies have shown that if computers exhibit social cues, people will treat them as social actors rather than as inanimate tools (Lombard and Ditton, 1997; Nass et al., 1995).

People tend to feel that computer elements are friendlier, more attractive, and more helpful if they exhibit social cues such as "teammate label" and praise (Fogg and Nass, 1997; Nass, Fogg and Moon, 1996). People can recognise emotions from the facial expression of a person, thus, visual cues involving faces are considered to be the most influential. The symbols of facial expressions such as emoticons have been applied in human–computer interface as a way of communicating feelings (Ekman, 1993). Social persuasive tools on the Web interface, such as an image of a smiling person or a friendly instructional agent could be perceived as social actors to improve engagement and motivation (Lee, 2009).

Researchers have also explored the effects of virtual peers that flatter. Fogg and Nass (1997) found that praise from a computer is extremely powerful especially when users are praised regardless of their actual performance of the task. Computer praise makes people feel better about themselves and their performance and there appears to be no difference in impact between human and computer praise. It is argued that current computer applications are heavily geared toward critical messages rather than praising ones. The study finding showed that a significant opportunity exists for enhancing the user experience. For example, adding either sincere praise or flattery to training and tutorial software may increase user enjoyment and task persistence.

Web-based persuasive elements can be simple text messages that convey empathy ("Don't worry, that's not your fault" or "Well done!") or icons that portray feelings such as an emoticon (Tung and Deng, 2007; Lee, 2009) or a smiley (Derks et al., 2007), or polite feedback and hints from intelligent tutors ("Let's convert the units

of the first item" as opposed to "Convert the units of the first item now") (McLaren et al., 2011). Participants in these studies responded to simple computer interfaces as though they were responding to a human being and reported feeling better about themselves when they were praised by a computer.

Mumm and Mutlu (2011) in their study on designing motivational agents, found that when praised, low-performance participants persisted in the task longer than those who were in the high-performing group. The mere presence of an avatar on the screen increased their motivation. This does, however, imply that the high-performance group did not benefit from the motivational agents.

The above studies imply that the social exchanges between people and computers generate emotional responses which mean that virtual peers could potentially compensate for the absence of real peers. Consequently, this study explores the Web-based virtual peer paradigm further and specifically tests if the use of a high fidelity avatar posing as a student and saying encouraging words, the presence of images of smiling students and encouraging text, can provide social support thereby increasing Web-based learning self-efficacy levels in nursing students. These different fidelities are explored in the next section.

2.5.2 Fidelity of Virtual Peers

Virtual peers are designed either as high or low fidelity. High fidelity virtual peers are richly defined agents such as avatars and sophisticated pictorial representations involving natural language processing or artificial intelligence. The image of a high fidelity agent can either be presented as static or as animated picture (Mayer and Moreno, 2002). In comparison, low fidelity agents are superficial image manipulations such as emoticons and static images. In terms of their ability to

convey social persuasion, all agents need to have one common characteristic: they need to exhibit personality. The desired personality can easily be created using a minimal set of cues such as sad or happy faces, polite or bossy. Examples of high and low fidelity agents are presented in Figure 2. The differences between high and low fidelity agents are discussed next.



High fidelity virtual peer (Kim and Sundar, 2012)



Low fidelity virtual peer (Fogg, 2003)

Figure 2. Examples of high and low fidelity agents

High fidelity virtual peers are life-like graphical representations of a person. They may take either a three-dimensional form, as in games or virtual worlds, or a two-dimensional form as an icon in Internet forums and other online communities. High fidelity virtual peers such as avatars can be two-dimensional or three-dimensional and they are either mute or can 'speak' using pre-recorded synthesised or real human voices. They can also be designed to be interactive using pre-defined search terms. High fidelity virtual peers are created using purpose-designed graphical software such as Toonlet© or Doppel Me© (Baylor, 2011) and can be expensive to develop.

Numerous studies have been conducted to evaluate the specific characteristics of high fidelity virtual peers and how people perceive, comprehend and respond to them. Most of the studies conducted were on pedagogical instructional agents (Domagk and Niegemann, 2005, Heidig and Clarebout, 2011, Tien, 2010) and their 'technological' characteristics; for instance voice, politeness, looks and gender in a variety of contexts (Gulz and Haake, 2006, McLaren et al., 2011, Rosenberg-Kima et al., 2008, Lee, 2010). Pedagogical agents are avatars presented on a computer screen that guide users through multimedia learning environments. Therefore, the agent's image on the screen is a defining feature of pedagogical agents. Although some researchers argue that the agent's voice is more important than its physical presence on the screen (Mayer, Sobko and Mautone, 2003), the mere presentation of a voice is not normally considered a pedagogical agent.

The implementation of high fidelity pedagogical agents is an attempt to introduce more instructional support and motivational elements into multimedia learning (Clark and Choi, 2005). Some studies expect them to foster learner motivation and learning outcomes due to the social cues they provide (Atkinson, 2002, Baylor, 2011, Johnson et al., 2000), others express concerns that they may distract the learner from the learning content (Dehn and van Mulken, 2000, Parise et al., 1999). It is not yet clear whether the presence of pedagogical agents facilitates the learners' motivation and the learning outcome.

Few studies investigated the use of avatars in a non-pedagogical capacity. Baylor's (2011) study on design of agents and avatars for enhancing motivational and affective outcomes (such as improving self-efficacy) found that the agent's appearance is the most important design feature as it influences the student's

perception of the agent as a virtual peer. The virtual peer's voice was also found to be a key motivational design feature. Therefore, even though the use of high fidelity agents as persuasive agents is still developmental, it seems that learners do respond to their presence on the computer screen.

Much less research has been undertaken involving low fidelity social actors such as images and text. However, the foundation of CASA, is that people respond to low fidelity social actors in the same way as high fidelity actors (Nass , Moon, Fogg, Reeves and Dryer, 1995). In contrast to high fidelity virtual peers, images are easier to produce. For example, Fogg and Nass (1997) designed interface elements that were simple dialog boxes with no onscreen characters, computer voices or artificial intelligence. Yet participants in the experiments responded to these simple computer interfaces as though they were responding to a human being. Among other things, they reported feeling better about themselves when they were praised by a computer and reciprocated favours from a computer.

The earlier versions of Apple Mackintosh operating system used static facial icons of happy Mac and sad Mac, representing the computer's 'emotional' state. The icons made the computers seemed user-friendly and accessible. Earlier studies found that presenting human faces in a system helps increase a successful human–computer communication (Takeuchi and Nagao, 1993). This finding is still valid currently where users often use emoticons as visual cues to expand the meaning of textual electronic messages sent from mobile phones (Tossell , Kortum, Shepard, Barg-Walkow, Rahmati and Zhong, 2012).

Despite the potential of low and high fidelity virtual peers to provide an encouraging 'voice' of support, no studies have explored their use as a source of social persuasion in increasing WBLSE.

2.6 Research objectives

This review has positioned the overall study within the research area of Web-based learning self-efficacy in nurse education. The sources of self-efficacy in self-directed or in blended learning settings were examined and the role of social persuasion in Web-based learning was discussed. The importance of social persuasion in increasing students' beliefs in being able to use the Web for learning was highlighted and the potential of virtual peers to compensate for the absence of real peers in providing social support was explored. The CASA theory was argued to be a suitable framework that can be used to provide social persuasion through various fidelities of virtual actors in the absence of real peers.

In the light of the above review, this study aimed to address the following research questions with both pre-registration and post-registration students:

1. Does the nursing students' WBLSE improve as a result of training?
2. Does the format of delivery impact on nursing students' WBLSE?
3. Does the presence of social persuasion impact on nursing students' WBLSE?
4. Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

In meeting the research objectives, an experimental design was adopted. This included the development of a bespoke training package used as an intervention for Web-based learning self-efficacy.

2.7 Conclusion

This chapter presented a review of the literature on using virtual peers to provide social support for Web-based learning in nurse education. The self-efficacy concept and Computers as Social Actors theory were discussed as a theoretical framework that informed this study in the context of Web-based learning.

The next chapter describes the development of a bespoke training package which was used in this study as an intervention for changing Web-based learning self-efficacy.

Chapter 3: Design and development of the 'Succeeding at Web-based Learning' online training package as an intervention for Web-based learning self-efficacy

3.1 Introduction

The previous chapter discussed the role of social persuasion in increasing Web-based learning self-efficacy (WBLSE) in preparing nurses for Web-based courses. Self-efficacy literature suggests that nursing students accessing Web-based learning in self-directed settings lack the advantage of having social support from peers present in blended learning environments. This may result in a feeling of isolation and anxiety about their learning and a lack of confidence in accessing Web-based courses.

This research explored how virtual persuasive agents could potentially provide the social persuasion needed to change WBLSE in self-directed settings in the absence of real peers. To address the questions asked in this study, a bespoke online training package called 'Succeeding at Web-based Learning" was designed and developed as an intervention to increase WBLSE. It is argued that adopting the User-Centred Design (UCD) framework in the design and development of the training package was essential to ensure that the online package adhered to defined web usability and accessibility standards in education and industry, thus ensuring an effective Web-based learning package. As part of the UCD process, a preliminary survey tool was used with a sample target user group to understand the user characteristics, identify the common tasks typically performed within the specific domain of Web-based learning and the knowledge and skills needed to carry them out. The results of this survey informed the development of the

package training content. This chapter discusses how the UCD process allowed for improvements and new iterations of the training package to be made following pilot sessions with sample user groups. Since virtual persuasive agents formed a critical part of the training package user interface, the Computers as Social Actors (CASA) theory reviewed in Chapter 2 informed the choice of social actors used to provide social persuasion in the WBLSE intervention.

3.2 Characteristics of Web-based learning websites

In order to determine the appropriate approach to take in developing the Succeeding at Web-based Learning package, a brief overview on websites used for learning (such as an online training website or virtual learning environment) as opposed to other websites (such as informational, commercial and entertainment) is given. An indication of the typical tasks and activities that students undertake is outlined, along with the motivations for using the website for learning and the skills and support needed.

All websites are organised by linking Web pages together to present chunks of content. The underlying Internet protocols enable the exchange of resources such as text and images over the World Wide Web (Berners-Lee et al., 1993). At a basic level, users browse or interact with the content using a Web browser either in a linear or non-linear way by clicking on hyperlinks, typing in free text or selecting responses from pre-defined options presented as dropdown menus or check boxes. Each website serves a purpose which ideally meets the aims of its target users.

Non-educational websites are generally designed to provide information and services which fulfil personal requirements that are not directly related to learning.

Examples of such websites are entertainment (such as music download), online shopping (such as household goods and holidays) and banking. Online tools such as Web-based email, document sharing (such as GoogleDocs), image sharing (such as Flickr) and videos (such as YouTube). Despite the differences in purposes and target audiences, educational and non-educational websites have functional overlaps. For instance, Web-based email and online document sharing are common tools used for personal communication and to support collaborative learning activities. Social networking tools such as Facebook and Twitter are increasingly being explored for their pedagogical potentials to enhance blended learning and to facilitate peer support in learning environments (Chumley-Jones et al., 2002). It could be argued, therefore, that the knowledge and skills to carry out tasks and activities for using the Web for learning, therefore, may be similar to those needed for using non-educational websites.

Educational websites, however, are specifically designed to support the pedagogy of blended and self-directed learning appropriate to the course content (Hopgood and Hirst, 2007, Huang et al., 2010). A website used for learning consists of a series of Web pages that have been developed and structured to deliver learning materials to meet identified learning outcomes. Students access these websites generally as a reference or as part of a distance or blended learning course that they are enrolled in (Tallent-Runnels et al., 2006). Web-based learning materials are a combination of static or interactive pages, various file formats and multimedia such as video clips, collaborative tools such as discussion forums (Littleton and Whitelock, 2005), online exercises such as reflective writing, formative quizzes and summative assessments (Narciss et al., 2007).

Websites for learning are typically presented either as part of a static course website or organised in a virtual learning environment package such as Blackboard, WebCT or Moodle (Moule et al., 2011) or as standalone resources. The level of content and presentation ranges from basic course websites containing links to general course documents (such as course handbooks, timetables and lecture handouts) to a more Web-dependent course delivery using tools such as discussion forums and interactive learning resources. Khalifa and Lam (2002) referred to these two levels of deliveries as Distributed Passive Learning where students access learning materials in PowerPoint or Word format, and Distributed Interactive Learning where students encounter interactive learning materials such as animations.

In addition, in large educational institutions, websites for learning generally include administrative course documents and resources, for example links to library records, printing allowances and exam results. Hence, educational websites become part of the institutional multiple online systems which students access through a one-stop portal website or a virtual learning environment (Tallent-Runnels et al., 2006, Moule et al., 2011). This suggests that often students do not have alternative ways for obtaining these resources and information other than through the institutional systems; for instance paper copies of learning materials and course documents are not provided. Therefore, it is important that students have sufficient knowledge and skills to access any Web-based information or resource that they need as part of their course, whether it is passive, interactive or administrative.

Student access and usage of WBL is goal-based, task-orientated and deadline-driven (Abdelaziz et al., 2011). For instance, students may access their educational

website to print timetables, download handouts or podcasts from missed lectures, post a message to a discussion forum, watch a video clip of a case study before a group discussion (flipped learning), and complete a summative quiz and so on. For a novice Web-based learner, accessing an educational website to achieve these goals may be a daunting prospect. Navigating through a vast amount of information and encountering unfamiliar formats of learning materials may lead to feelings of anxiety (Kozlowski, 2002). If students get lost and fail to recover from unexpected Web browser behaviours such as broken links, they may give up the task altogether. Dropouts from Web-based courses have been reported (Levy, 2007) and studies have been conducted to predict dropouts and make recommendations to improve online teaching (Nistor and Neubauer, 2010). Other studies reported that students who do not have the knowledge and skills to carry out these tasks turn to their peers, family and friends for support (Bond, 2010).

In addition, educational websites can be accessed not only from desktop computers but increasingly from portable devices such as laptops, tablets and smartphones. These platforms deliver websites for learning on a variety of proprietary or open source Web browsers (such as Internet Explorer, Firefox and Google Chrome) which potentially require specific Web plug-ins or the latest browser versions to run interactive learning materials. The Web browsers often have their own unique characteristics and terminology such as Bookmarks (Firefox and Chrome) and Favorites (Internet Explorer). Even though accessibility and usability guidelines exist to ensure that learning websites perform as expected on all browsers and platforms (including mobile devices), a positive user experience cannot be guaranteed in all cases. Hence, faced with unfamiliar and inconsistent navigational tools, students without the necessary knowledge and skills may lack

the confidence in carrying out the activities associated with using the Web for learning.

In addition to course documents such as module handbooks and timetables, websites for learning also include multimedia content such as video, animations, online activities such as drag-and-drop questions and quizzes. However, although the incorporation of multimedia in Web-based courses can improve learning (Mayer, 2005) and motivation (Wang and Reeves, 2007), it is argued that interactive learning materials such as animations and online tests may result in higher cognitive load which may add to feelings of anxiety in novice online learners. Therefore, it is important that any interactive content is designed to be accessible for users with a range of Web skills.

Online learners need to be responsible for their own learning (Mahoney et al., 2005) and be self-regulated (Narciss et al., 2007) but they also need guidance in the appropriate ways of undertaking Web-based learning tasks (Chang and Yang, 2010). Hence, it is essential that students have the necessary knowledge and skills in undertaking Web-based courses to be confident online learners.

3.3 Designing an online training package

As discussed above, educational websites extend the role of the Web beyond that of a mechanism for the distribution of information, and they are implemented as a tool to enhance the learning and teaching process. Prior to the development of any type of online intervention to prepare nursing students for Web-based learning, it is essential that the developer has a good understanding of the requirements and the user characteristics of the potential users of the training website. The researcher on this study is also a Web developer by profession. She is a lone

resource whose time is committed both to develop the training package and also to develop the WBL websites that nursing students will be accessing as part of their course. Therefore, the rapid turnaround of training package development and limited resources necessitate an effective design, development and evaluation process built into the tight research project schedule. Hence an effective design framework for developing the training package is necessary.

The bespoke online training package developed for this study will be used by nursing students (the target primary users) during the first week of their course. Post-registration students in particular will be accessing the package during the first day of their 8 to 12 week continuing professional development modules. It is therefore essential that the training package is highly effective in delivering its objectives.

This section describes the design process that was followed to ensure that the interface of the training package met the user requirements and that the content fulfilled the learning objectives defined as part of this research study.

3.4 The User-Centred Design process

The main rationale for adopting a framework for designing the training website was to ensure that the website was intuitive, usable and free of errors. The consequences of not having the appropriate design process may result in user frustration and technical errors (Nahm and Resnick, 2008, Bloomfield and Jones, 2013). Additionally, there is a danger that the design of the website becomes 'developer centric'. In the context of this study, any technical difficulties that the users encounter due to system errors and poor navigation would compromise the

objectives of using the website as an intervention method for Web-based learning self-efficacy.

Incorporating a human computer interaction (HCI) perspective into the training package development life cycle is necessary to ensure that the usability of the website is sound. Usability principles aim to make data exchange between people and machines less stressful and less prone to misunderstandings, thus increasing efficiency of tasks that involve both the human and the computer (Preece et al., 2002). The standardised definition of usability is the 'extent to which a product can be used by specified users to achieve specified goals with *effectiveness*, *efficiency* and *satisfaction* in a specified context of use' (Jokela et al., 2003, p53). In this study, usability is used to refer to features that make a website easy to use, easy to learn and remember, efficient, visually pleasing and a pleasure to use. This is a particularly important consideration in the design process of the training package in this study due to the intended purpose of the website to train students on how to use the Web for learning.

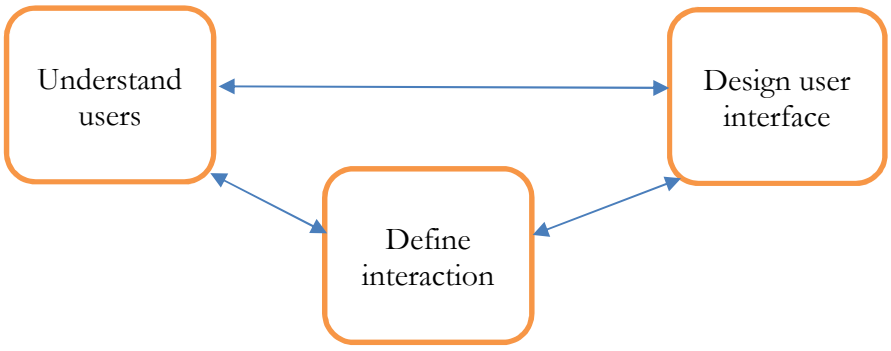


Figure 3. User-centred design

The user-centred design (UCD) process adopted to inform the development of the training package in this study is represented in Figure 3. UCD is an established approach for employing usability (Bødker, 2000) originated in Donald Norman's

research laboratory at the University of California San Diego in the 1980s. The approach became the standard for recognising the needs and the interests of the user and focuses on the usability of the design (Abras et al., 2004).

UCD is a structured development methodology that involves users throughout all stages of website development in order to create a website that meets users' needs and is used widely as standard practice in industry and education. It is argued that this approach considers the research project objectives and the users' needs, limitations and preferences. It is important to understand who the users are and what they need to do to accomplish the tasks as part of the training. The UCD process is iterative so that as errors in design are discovered through testing and pilot checks, the website developer can start the process again after clarifying the user requirements. From the project timeline perspective, the UCD approach will reduce operating and redevelopment efforts by developing the website correctly the first time around.

Hence, to create a user-centric training package, it was necessary for the study (and the researcher) to 'step out' temporarily from the overall research questions addressed in this study and for the researcher to wear her 'Web developer' hat to clearly define the users' needs, goals and objectives when using the training website.

3.4.1 Preliminary survey to understand user characteristics and to identify Web-based learning interactions

The intended primary users of the training package were student nurses. In order to understand the background of the student nurses, a preliminary survey was distributed to a sample of the target audience who would be using the training package as part of the study. The intended outcomes of the survey were to inform

the next step of the design process (i.e. define interactions) of the training package and specifically answer the following questions:

1. Who are the users of the training package?
2. What are their tasks and goals in using the Web for learning?
3. What skills do they need in carrying out these tasks?
4. How do users think the training package should work and what are their experience levels of using websites in general?

In the context of this study, the learning websites that nursing students access are hosted on a virtual learning environment called WebCT. The online course presence on WebCT has a shelf-life of 6-12 months after which they must be updated with new content such as module handbooks, timetables and fresh discussion forums at the start of a new semester. Learning resources and tools will be updated accordingly following any changes in learning objectives and pedagogy.

The formative survey was part of the process of gaining an overall picture of the intended study population and users of the training package. Even though the results of the survey were self-reported, students' perceived WBL knowledge and skills would inform the development of possible online learning materials. The inclusion of attitudinal questions in the initial survey also aimed to confirm findings by other 'reaction capture' studies discussed in Chapter 2. A full version of the survey is provided in Appendix 1.

3.4.2 Participants

Post-registration nursing students, as opposed to pre-registration nursing students, were selected because they were the more challenged group of Web-based learners and would incorporate any common requirements from the two groups of

students. Post-registration nursing students undertake continuing professional development modules in short time periods and take time out of work to do this. In addition, the nursing profession does not have a definition of what constitutes an appropriate competence for ICT knowledge and skills upon exiting a pre-registration course. This makes it difficult to 'welcome' post-registration nurses back into continuing professional development education (Delf, 2013).

A 65-item questionnaire survey adapted from Sinclair & Gardner, 1999 (Sinclair and Gardner, 1999) was used. A nursing expert group reviewed the questionnaire to ensure face and content validity. Permission to conduct the survey was gained from the University of Nottingham School of Psychology Ethics Committee in 2006 (Appendix 2). The questionnaire was piloted to students taking another module on the Learning Beyond Registration course who would have taken a first module in Evidence-Based Practice previously. As a result, minor corrections to questions were made to improve clarity.

The survey was distributed to 206 registered nurses taking a mandatory continuing professional development (CPD) module on evidence-based practice. The nurses were enrolled on the Evidence-Based Practice (EBP) module which was a 20-credit level 2 or 3 compulsory module on the undergraduate nursing Learning Beyond Registration part-time course delivered at the University of Nottingham. All students registered on a diploma or degree level were required to take this module prior to other modules on the course. The EBP module assessment was delivered through WebCT; all teaching sessions were held in the classroom. Students also had access to relevant Web-based resources. A paper-based (as opposed to online) questionnaire survey was chosen as a method for the

preliminary data collection because paper questionnaires were convenient to distribute to students in the classroom.

3.4.3 Survey results

The participants consisted of 186 females and 20 males. The age range was between 21 and 59, with a mean of 36. Most of the participants were qualified in the UK between 1973 and 2006 and had been in their current job between 32 years to less than 12 months. The respondents comprised two-thirds of the diploma/degree population (304). It was not possible to be certain of the actual numbers of module attendees due to the administrative problems in working for the National Health Service. Students who had initially registered for a module might not be able to attend the course at the last minute due to difficulties in obtaining study leave and shortages in staffing resources. The questionnaires were distributed to all nurses who attended on the first day of the module. On this basis, 100% return was achieved.

3.4.4 User characteristics

Even though the nurses generally rated themselves as having medium to high Internet skills, 30% admitted to feeling anxious or very anxious about starting a Web-based course. The 23% that considered themselves as having insufficient skills indicated that they needed training in basic computer and Internet skills, "to give me confidence" and indicated that they would like some support and to be shown the systems they needed to use before starting the module.

Half of the participants who did not know that the EBP module had a Web-based component admitted to feeling anxious. A closer look at the results revealed that those who considered themselves as having sufficient skills, would also have liked

an introductory session to the Web-based learning environment, for example WebCT and Athens (an online journal database), that they would be expected to use. Remarks such as "Step by step access to journals", "Pre-course awareness information", "The knowledge that a WebCT was part of the course" were typical. This could indicate that they probably had the skills needed for Web-based learning but would appreciate a more contextualised training that would have given them an idea of the various Web-based systems that they would be using. Those that considered themselves as having insufficient skills also wanted an introductory session about what to expect on the course. In addition they would also like basic computer skills training such as "How to use email", "Using Microsoft Word etc" and "Basic computer skills training for novices like myself".

3.4.5 Interactions requirements

1. How do users think the training package should work and what are their experience levels of using websites in general?
2. What are their tasks and goals in using the Web for learning?
3. What skills do they need in carrying out these tasks?

Simple descriptive analysis of the survey results was carried out. The results identified the following knowledge and skills as essential for nursing students to be able to use the Web as a tool for learning:

1. Having a general understanding of how websites work
2. Bookmarking Web pages
3. Downloading files from websites
4. Exploring the online learning environment
5. Participating in online discussion forums

The formative survey results indicated that nurses use computers at work mostly for data inputting or looking up patient information or test results. 56% admitted to not knowing how to bookmark a Web page or that they didn't know if they could bookmark a page even though they rated themselves as having medium or high internet skills. A proportion of students did not know how to download a document. 24% of nurses who rated themselves as having medium or high email skills did not know how to send an email with an attachment.

71% of the participants wanted some kind of pre-course preparation. Some nurses reported feeling anxious about undertaking a course with Web-based learning components. This feeling of anxiety was expressed explicitly in the attitudes to Web-based learning scale and implicitly through their training needs and choice of training delivery methods. The indecision of some nurses about their feelings towards Web-based learning may be an 'unspoken' message that they don't know how to feel about something that they don't fully understand. This is consistent with earlier studies (for example Atack & Rankin (2002) and Adams & Timmins (2006)) which reported that students initially express concerns about Web-based learning because of their limited familiarity with computers (but then become active participants after a short coaching input).

Nurses who rated themselves as having medium to high IT skills and considered themselves to have sufficient skills to do a Web-based module still preferred to have some computer and/or Internet training before starting the module. They specified that the training should consist of an introduction to the various Web-based learning platforms that they are expected to use such as WebCT and online journals. In contrast, those who considered themselves as having insufficient skills

specified basic computer training that included use of applications such as Word in addition to an introductory session of the Web-based learning environment.

In terms of training content, the participants indicated that information about the module and its Web-based learning component prior to start date would have been useful ("could have told us prior to registration", "the knowledge that WebCT was part of the course", "Pre-course info sheet on expectations from students", "part module as a taster and trial with hard copy as back up"). They also identified specific training needs such as accessing journals on the Web, how to use the Web and how to use Word.

On the whole, the nurses showed readiness in using the Web for learning. However, they were also anxious about embarking on a Web learning journey on their own. The preliminary survey identified that post-registration students expressed anxiety in participating in a course with Web-based components and felt they needed training prior to starting it. In addition, those that did not have the basic essential Web skills would need additional basic Web usage training.

3.5 Development of "Succeeding at Web-based Learning" training package

3.5.1 Design of the user interface

The results from the survey subsequently informed the development of a bespoke training package as a mechanism for preparing nurses for Web-based learning and as an intervention for increasing their WBLSE. This section describes the development of the training package incorporating the interactions (tasks) that users have defined in the previous step of the UCD process.



Figure 4. WebCT homepage screenshot

The online training package called 'Succeeding at Web-based Learning' was developed specifically for this study by the researcher using a Web-based learning environment called WebCT (Figure 4). One of the essential WBL preparation aspects that the students identified in the preliminary study was familiarisation with the Web-based learning environment that they would be using as part of their course. The students participating in this study would be using WebCT throughout their course to access course and learning materials. The Succeeding at Web-based Learning training package was therefore embedded into WebCT. This would provide students with a real experience of navigating the learning resources within WebCT. The training package therefore was provided in an authentic environment

giving the students the opportunity to practise and develop such skills in a truly situative environment (Woolley and Jarvis, 2007, Brown et al., 1989).

The package had 18 pages incorporating sections containing learning materials for the knowledge and skills identified from the background study: understanding links, searching and bookmarking, downloading, exploring the WebCT interface and posting a message on the discussion forum on WebCT. Searching was included to give context to the bookmarking examples and exercises. Each section was preceded with an explanation and examples in the form of short 'show-me-how' videos (see screenshots in Figure 5) followed by some exercises which were mapped with intended learning outcomes. The mapping is presented in Table 1.

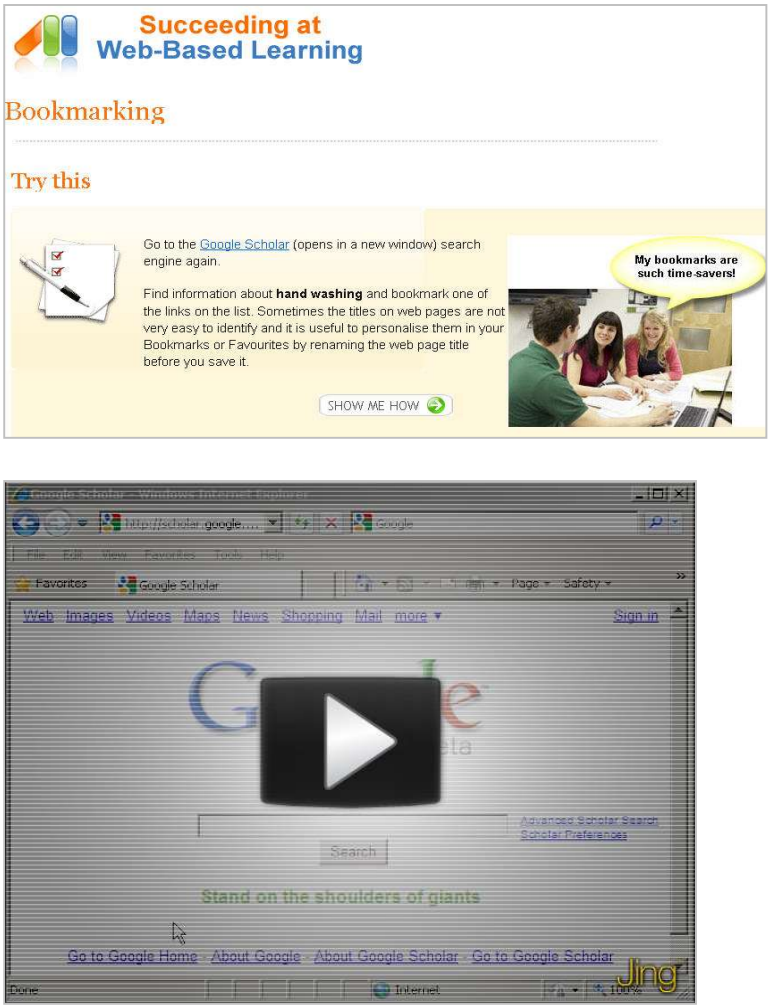


Figure 5. Screenshots of video clip image links

Table 1. Mapping of learning objectives with the learning materials

Learning outcomes	**Learning materials**	
	Theory and examples	**Exercises**
Understand the concept of hyperlinks and the navigation menu	Description of a website and different types of hyperlinks (onsite links, inbound links, inbound bookmarks, anchor links, dead links) What links look like (e.g. text link, image link, visited link) Examples of what happens when links are clicked Example of what happens when a dead link is encountered	Click on an inbound link to a Cell Division reusable learning object (RLO) which is hosted on a separate website Spend no more than a couple of minutes clicking on the links on the RLO pages Click on the dead link example. Click on the browser Back button to recover from it
Know how to search for information	Description of searching, search function within a website and search engines Explanation and examples of various searching tips (e.g. using quotation marks, plus or minus)	Go to the Google search engine and look for information about the film 'Mamma Mia' 'Show me how' video clip demo is given Go to the Google Scholar search engine. Find information about hand washing. This time put quotation marks around the phrase "hand washing"
Know how to bookmark Web pages and organise bookmarks	Definition of bookmarking including different browser terminologies 'Show me how' video clips	Go to the Google Scholar and find information about hand washing. Bookmark one of the links on the list. Rename the Web page title before you save it Categorise your bookmarks by putting them in sub-folders
Know how to download documents	Definition of downloading. Different types of file formats that can be downloaded How to download and save a document on the computer desktop How to create a folder on the computer desktop to put all downloaded documents 'Show me how' video clips	Click the link that points to the PDF version of the Assessment Guidelines for the Evidence Based Practice module. When the document opens up, save it on your computer desktop Create a new folder on your computer Desktop and name it 'Downloads' Download the Evidence Based Practice module handbook and put it in the Downloads folder
Explore the WebCT interface	Description of WebCT and the navigation menu in WebCT	Take a couple of minutes to explore the WebCT navigation menu
Know how to post a message on the discussion forum on WebCT	Description of the discussion forum in WebCT 'Show me how' video clip is given	Post a message on the forum. Reply to the test message or create a new topic

At the end of the training session, the student would be able to:

1. Understand the concept of hyperlinks and the navigation menu
2. Know how to search for information
3. Know how to bookmark Web pages and organise bookmarks
4. Know how to download documents
5. Be familiar with the WebCT interface
6. Know how to post a message on the discussion forum on WebCT

The results from the preliminary survey suggested that the post-registration students came from differing backgrounds and had a wide range of knowledge and skills. The variety of audiences poses a challenge for Web content developers who are unable to account for individual cognitive demands and learning styles in advance. In addition, the context of learning is often spontaneous and website users rarely navigate online content in the same way (Hill and Hannafin, 2001). The basic hyperlinking characteristic of websites affords the non-sequential organisation of information content and the facility for allowing the linking of conceptually related information such as WBL knowledge and skills. Despite this flexibility, designing learning materials relating to WBL knowledge and skills involves the explanation of website concepts and functionalities such as different types of hyperlinks and bookmarking. These concepts may be dry and uninteresting to novice Web-based learners. They may feel daunted and find it difficult to associate the learning materials to real WBL tasks to achieve course-related outcomes. For instance searching for information more effectively using wildcards or organising bookmarked online resources may seem unrelated to their immediate goal of needing to access module handbooks and reading lists. The

training package therefore needed to be designed to cater for all ranges of student backgrounds and capabilities.

As discussed in section 3.2, when navigating a website, users have to carry out multiple tasks simultaneously. They have to navigate through the website in addition to reading and understanding the contents of the information it contains. Performing both tasks concurrently in this way imposes a high level of cognitive load. Studies showed that presenting small units of information on the screen at any one time helped learners grasp concepts more easily (Hannafin et al., 2009, Windle and Wharrad, 2010). People can only process a few elements of information in working memory at any time (Sweller, 1994, Kalyuga et al., 1999). Too much information and too many hyperlinks make learners feel "lost and wondered if I needed to study them all in detail."(Sit et al., 2005, p144). In addition, from the viewpoint of Web usability, websites are constrained by the constricted viewing window of the computer screen.

The learning materials in the Succeeding at Web-based Learning training package were therefore 'chunked' into absorbable pieces (Piccoli et al., 2001) to prevent the students from feeling overwhelmed. The Web pages were designed to be uncluttered with minimal or no scrolling down the screen. Essential information for grasping the concepts and completing the exercises was provided without exhausting students with too much written content. Breaking learning objects into discrete units of learning has been found to be effective in improving learning performance of nursing students, for example in studying concepts of pharmacology (Lymn, Bath-Hextall & Wharrad, 2008) and meta-analysis applied to evidence-based practice (Bath-Hextall et al., 2011).

The WBL knowledge and skills exercises in the training package were contextualised to the outcomes that students were required to achieve when accomplishing tasks required as part of their Web-based course. In other words, the training materials were real WBL tasks (for example downloading a module handbook and posting a message to a discussion forum) as opposed to training about using the computer or a particular browser (Ortiz de Guinea and Webster, 2011). In addition, the examples in the exercises were specifically chosen to be meaningful and to give students the motivation and satisfaction for completing the exercises. For instance, to illustrate the concept of hyperlinks and navigation menu, a link to a hand washing learning resource on an external website was given. Students in previous studies reported that contextualising exercises to learning resources in this way enabled them to see "WBL as a way of applying understanding in a different way", "can connect to rich resources of learning materials. Can get more practical examples" (Tsai, 2009, p1100). The students were motivated to engage in the learning task and as a result they did not just learn the WBL concepts but they also understood the reasoning behind the concepts (Hannafin et al., 2009, Shih and Gamon, 2001).

The Succeeding at Web-based Learning training package used high quality graphics and audio to help engagement with the material and to facilitate learning (Sit et al., 2005). Previous studies reported that students respond well to online resources that are interactive, visual, small in size and closely aligned with their learning outcomes (Childs et al., 2005, Lymn et al., 2008). In this training package the video clips demonstrated how to carry out some of the WBL activities, for example how to create a custom folder on local computer desktop to enable students to find downloaded course documents again later.

3.5.2 Virtual persuasive agents

The primary aim of this research was to investigate if the presence of virtual persuasive agents could provide social persuasion in the absence of real peers. As discussed in Chapter 2, the Computers as Social Actors (CASA) theory argues that humans tend to respond to virtual peers as if they were real peers. An anthropomorphised avatar called Alison was present on five of the pages (30%) in the first iteration of the package. She acted as a supportive and sympathetic current student who started the course with minimal Web-based learning skills but managed to improve her skills by using the same training package. She would say encouraging (but not instructional) words such as "When I first used Google, I was impressed by the amount of information that's available out there. However, sometimes I still can't find what I'm looking for and I get quite frustrated! Don't worry, it took me a while to get used to it too!".

Alison's characteristics were programmed to closely represent the general demographics of the nursing students as informed by the previous pre-registration study. Behrend and Thompson (2011) reported that the greater the similarity or the better the participants can relate to the social agent, the greater the potential for it to be socially persuasive. 90% of the participants in the previous study were female aged between 20 to 49 years old (M=25.56). Alison was therefore programmed to be female and within the mean age range. She was dressed in professional attire, as opposed to casual or sporty, to represent the professional nature of the nursing profession. She was smart-looking and friendly in order to make her appear trustworthy and approachable. Her facial expression was pleasant and friendly. See screenshot in Figure 6. Her speech, however, was created using a text-to-speech software and not a recording of a real person's voice. Therefore,

her speech was discernible but recognisably synthesised. This ensured consistency with her anthropomorphised appearance.



Figure 6. Screenshot of Alison

Alison was incorporated throughout the training package as a one-way communication. In other words, participants were not able to converse with her or ask her questions. She appeared automatically on specific pages without being prompted. Therefore, students did not have to 'play' her in order to listen to her. She was programmed to play once throughout the package although students had the option to replay any of her videos during the training session.

The photos used in the package were chosen from the University of Nottingham image library. Photos of real nursing students in uniform were included to give a sense of authenticity to the low-fidelity social actor. Images of students looking at computer screens were also included to imply that the students were accessing the Web for learning (see example screenshot in Figure 7). All of the photos portrayed individuals who were smiling and looking happy.



Figure 7. Screenshot of students smiling and looking at a computer screen

The script for the encouraging textual messages was designed with care to ensure that the language was friendly, familiar but professional, easy to understand but not condescending or instructional. The words reflected positive affirmation of the achievements of a previous student who had used the training package before. For instance, "I used to get help when downloading documents. Now I save them all in my own folder!". The images were presented with the text to expand the meaning of textual messages and to provide additional social cues beyond what was found in text format.

3.5.3 Pilots and iterations

User Centred Design recommends that the pilot process of a website involves carrying out usability testing which involves real users to inform the improvement of the website's usability. Formal usability tests are conducted in usability laboratories that are staffed by people who are experts in user interface design and testing. However, this is not always possible due to costs and practicalities in participant travel and recruitment. In this research, the alternative testing techniques of heuristic and discount usability testing (Nielsen, 1993) were

employed instead. In heuristic evaluation, experts inspect the website using high-level heuristics guidelines such as user control and freedom. Discount usability evaluation claims that 3-5 reviewers identify around 80% of the usability problems (Preece et al., 2002).

However, involving users in UCD in one way or another has been shown to lead to the development of more usable websites. Hence, due to time restrictions on this research, the heuristics and discount usability testing were employed as methods to pilot the training website.

The training package was piloted with a group of 19 post-registration and 13 pre-registration students for usability. In addition, the materials used for Web-based self-efficacy measures were also piloted for content validity.

A heuristic evaluation with experts was conducted which aimed to find and prioritise usability problems and to evaluate designs in the context of tasks (Nielsen, 1992). The website experts consisted of four learning technologists and web developers based in the school of nursing where this study was undertaken. As discussed earlier, the website must be easy to use and be able to function as a standalone online system regardless of the overall research objectives in this study. The heuristic evaluation ensured the following (Nielsen, 1992):

- The website should always keep users informed about what is going on, through appropriate feedback, for example warning users that a hyperlink will open in a new browser window.
- The website should speak the users' language, with words, phrases and concepts familiar to the user, rather than website-oriented terms. Users

should not have to wonder if different words, situations, or actions mean or result in the same thing.

- The website should follow real-world conventions, making information appear in a natural and logical order. For example, signposts such as 'go to the next page' were included to facilitate the order of learning content.
- Users should have the control and freedom in navigating the website. They should not have to remember information from one part of the website to another. Instructions for use of the website should be visible or easily retrievable whenever appropriate. For example, the website 'breadcrumbs' that appeared at the top of each Web page afforded a way back to the Home page.
- All errors such as unintended broken links were eliminated. Error messages where necessary were expressed in plain language and not using default browser error codes.

Minor adjustments to content structure and usability were carried out based on feedback from the students and website experts. The training package was also accordingly revised in Study 3 to allow for the fidelity of the virtual peers to be investigated further.

The training packages were developed using a combination of Web design tools including Adobe Dreamweaver CS5 for writing the HTML pages and Cascading Style Sheets, Adobe Photoshop CS5 for image manipulation, Jing for producing the video clips and Sitepal© for creating the avatars.

3.6 Conclusion

This chapter described the design and development of the Succeeding at Web-based Learning training package used as an intervention to change student nurses' Web-based Learning Self-Efficacy. User-Centred Design was adopted as an approach to inform the development of the training package.

The next chapter explains how the training package was used in three quasi-experimental studies.

Chapter 4: Methodology on the evaluation of the intervention

4.1 Introduction

This chapter describes the quasi-experimental design adopted by this research to test the effectiveness of the Succeeding in Web-based Learning training intervention (described in Chapter 3) in changing web-based learning self-efficacy (WBLSE) in nursing students. This research attempted to answer four questions:

1. Does the nursing students' WBLSE improve as a result of training?
2. Does the format of training delivery impact on nursing students' WBLSE?
3. Does the presence of social persuasion impact on nursing students' WBLSE?
4. Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

The following sections describe how the training package was used in three separate studies with pre-registration and post-registration nursing students. The first two studies explored if WBLSE could be enhanced by a short intervention and if any improvement in self-efficacy was influenced by the format of training delivery and presence of virtual persuasive agents (questions 1-3). The third study explored if the fidelity of the virtual persuasive agents affected the improvement of WBLSE (question 4). The sampling strategy, measures, procedure, data analysis plan and ethical considerations are also explained.

4.2 Ethical approval

Since this research included 'healthy human volunteers' in a higher education institution (as opposed to a clinical trial in a hospital with patients), ethical approval was sought only from the School of Psychology, University of Nottingham. The following documents were provided to the committee for review: a completed application form signed by the supervisors; the project research proposal; the consent form; the information sheet and the materials for the empirical studies. Approval was granted for the empirical studies in 2008 with no changes. A copy of the approval document and submitted documents are presented in Appendices 3-7. The approval covered the administration of the survey, training package and associated measures in a higher education environment.

4.3 Research design

The overall aim of this research was to investigate if virtual peers could provide social support in the absence of real peers in increasing WBLSE. An online training package called 'Succeeding at Web-based Learning' was developed as a tool for providing the four sources of self-efficacy: social persuasion, vicarious learning, mastery experience and psychological states. As discussed in Chapter 2, Web-based learning (WBL) can be undertaken either in a blended or self-directed setting. In a blended learning environment, students have the advantage of learning with their peers and course facilitators. In a self-directed environment, they are learning on their own. The context in which the study was conducted was within a higher education environment with students enrolled on pre-registration and post-registration nursing courses during set periods of time.

In considering the design methodology for this research, the techniques employed must be appropriate for the research questions to be answered. The central feature of this study was to actively and deliberately introduce some form of change in nursing students' WBLSE. I wanted to examine the effects of the intervention. I was not investigating the experience or the attitudes of the students undertaking the training. Any technical experience in terms of possible usability shortcomings of the training package was addressed the User-Centred Design of the package as described in Chapter 3. The theories of self-efficacy, Web-based learning and Computers as Social Actors (CASA) (as depicted in Figure 8) informed the specification of variables included in the study and the exact procedures followed. The choice of variables to be targeted, manipulated or controlled as part of the intervention was clear. This suggests that there is a clear link between the research questions and theoretical framework (Robson, 2002). Consequently, given the aims of and questions explored in this research, an experimental strategy was deemed to be the most appropriate.

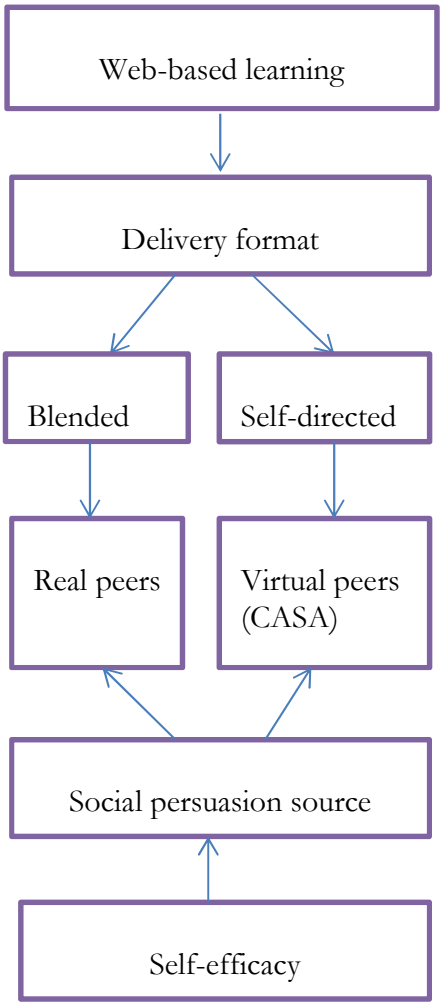


Figure 8. Web-based learning self-efficacy conceptual framework

The literature asserts that the 'gold standard' for experimental design is randomised control trials (RCTs) where participants are randomly assigned to control and experimental groups (Robson, 2002). Whilst such terms are contested, there is little argument that when conducting research in the 'real' world, it is not always practical or ethical to randomly assign participants to groups as it might be in an 'artificial' laboratory experiment. This research was carried out in the 'real'

world involving 'real' students enrolled on pre-registration and post-registration courses. Hence, participants were only available during the timetabled sessions. Because this research was interested in 'real' new starters, it was not practical during the time constraints of this research to invite the students to participate in the study before the courses started. In situations such as this where RCTs were not practical, researchers in quantitative traditions argue that quasi-experiments can be used as long as they are systematically carried out and the same requirements as the true experiment design are met to produce trustworthy outcomes (Gersten et al., 2005).

To ensure that the findings of quasi-experimental studies are credible and trustworthy, the design of the study must ensure that the results are valid, generalisable and reliable (Robson, 2002). Validity is concerned with whether the findings are 'really' about what they appear to be about. Are any relationships established in the findings 'true' or due to the effect of something else? In the context of this research, did the type of training improve WBLSE or was there some other factor at play? Was there a 'real' direct link between the training and improved WBLSE? Generalisability refers to the extent to which the findings of the study are more generally applicable outside the specifics of the study situation that is - will the findings of this study be applicable in other contexts, situations or times, or to persons other than the student nurses directly involved in the intervention? Finally, to ensure reliability, the study measures must be consistent or stable and produce the same results if they were to be repeated. These considerations guided the measures and procedures of this research and are explained further in the following sections.

Three main studies were carried out as part of this research: the design varied as appropriate to the research question addressed. Studies 1 and 2 addressed the following research questions:

- Does the nursing students' WBLSE improve as a result of training?
- Does the format of delivery impact on nursing students' WBLSE?
- Does the presence of social persuasion impact on nursing students' WBLSE?

In Studies 1 and 2, four different groups of students were set up for the WBL (blended or self-directed) setting and social persuasion (absent or present) setting which made it possible to exert some degree of control over the experiment. In addition, a non-intervention control group was used. The design for Studies 1 and 2 are presented in Table 2 and Table 3 which includes the number of participants in each group. The experiment involved measuring the effects of the manipulation of the training package delivery format independent variable (blended or self-directed) on the social persuasion dependant variable (absent or present) on WBLSE. The independent variable was actively manipulated so that different groups received different treatments.

Table 2. Study 1: Delivery Format and Social Persuasion (post-registration students)

		Delivery format		
		Self-directed group (without facilitator)	**Blended learning group** (with facilitator)	**Non-intervention control group** n = 26
Presence of social persuasion	**Training (no social persuasion)**	n = 25	n = 25	
	Training (supported by social persuasion)	n = 25	n = 25	

Table 3. Study 2: Delivery Format and Social Persuasion (pre-registration students)

		Delivery format		
		Self-directed group (without facilitator)	**Blended learning group** (with facilitator)	**Non-intervention control group** n = 17
Presence of social persuasion	**Training (no social persuasion)**	n = 16	n = 17	
	Training (supported by social persuasion)	n = 19	n = 14	

Study 3 addressed the research question:

- Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

In Study 3, separate avatar, images and text, and no images/text groups were formed to measure the effects of the fidelity of virtual peers on WBLSE (see Table 4).

Table 4. Study 3: Fidelity of virtual peers

Fidelity		
Avatar group	**Images/Text group**	**No images/text group**
n = 44	n = 43	n = 44

The flow diagram of the design of the study is presented in Figure 9. The User Centred Design that informed the development of the training package was discussed in Chapter 3.

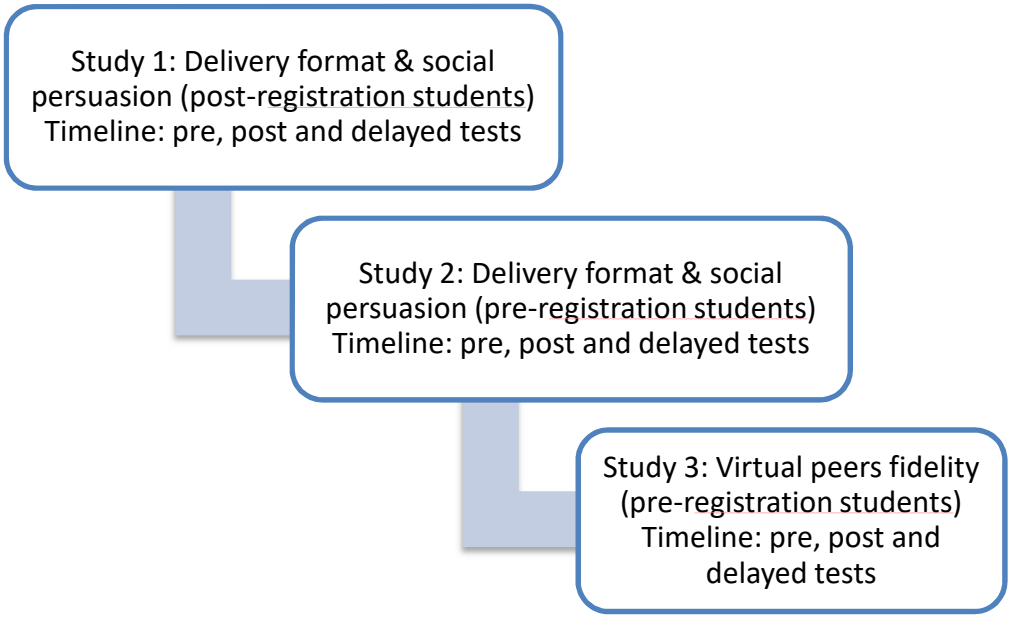


Figure 9. Flow diagram of the design of the study

4.4 Participants

4.4.1 Sampling Strategy

All students had to be free from the 'contamination' of previous institutional IT related sessions that could have introduced them to WebCT. Hence it was essential that the intervention occurred during the course induction week (first week of the course). The sample strategy is explained for the three studies.

Study 1: Delivery format & social persuasion (post-registration students)

All intakes of new students admitted as part of the Learning Beyond Registration programme were eligible to take part in the research. It was arranged with course directors, module leaders and administrative staff that the Succeeding at Web-

based Learning training was conducted as part of the induction programme during the first week of the course. Due to the amount of group and timetable disruption it would cause, it was not possible to randomise participants to experimental conditions and control group at individual level. Randomisation was carried out at group level instead.

The participants were University of Nottingham post-registration students. The participants were already part of recently randomly formed intact classes. The training sessions were timetabled as part of their induction weeks. The post-registration students were enrolled in level 2 or 3 continuing professional development modules.

Given the likely difference between pre- and post- registration nurses (as discussed in Chapter 3), it was important to test whether the findings would generalise to a different population.

Study 2: Delivery format & social persuasion (pre-registration students)

All intakes of new students admitted as part of the pre-registration diploma met this criteria. The sample comprised first-year students from all four nursing branches: adult, child, learning disabilities and mental health. Students were randomly assigned into groups by administrative staff.

Study 3: Fidelity of virtual peers (pre-registration students)

The sampling strategy was the same as in Study 2.

In Studies 2 and 3, the groups were in intact classes which determined the sample size. Randomising participants into experimental conditions and control group at

individual level was not possible due to the significant disruption to course organisation. Randomisation was carried out at group level instead.

4.5 Materials

For Studies 1 and 2, the following materials were used. For Study 3, the training package content was revised as explained in section 4.10.

The Succeeding at Web-based Learning training package was used in this study as an intervention tool for WBLSE. The learning objectives and learning content for WBL knowledge and skills were described in detail in Chapter 3.

As discussed earlier, students undertake Web-based learning either on their own (self-directed) or with others (blended). In blended learning settings, students will have the social support from their peers and are able to learn together. In a self-directed setting, students will not benefit from this. Therefore non-instructional social persuasion in the form of virtual peers has been incorporated in the training package to mimic the presence of real peers as depicted in Table 5, otherwise the materials were exactly the same in all conditions.

Table 5. Presence of virtual persuasive agents in the Succeeding at Web-based Learning training package

		Delivery format		
		Self-directed (without facilitator)	**Blended learning** (with facilitator)	**Non-intervention group** No training was given.
Social support	**Knowledge and skills training only (no social persuasion)**	Students working on the training materials on their own.	Students working on the training materials with real peers and a facilitator.	
	Knowledge and skills training supported by virtual social support (social persuasion)	Students working on the training materials on their own. Virtual social persuasion was provided in the form of an avatar, images and text.	Students working on the exercises with real peers and a facilitator. Virtual social persuasion also provided in the form of an avatar, images and text.	

Virtual social persuasion was in the form of a high fidelity avatar and low fidelity image and text. Pictures of happy students saying encouraging words in speech bubbles such as "Hooray, I managed to download my timetable!" or "I know all about links!" appeared on nine of the 18 pages. The avatar called Alison was present five times throughout the package. She acted as a supportive and sympathetic current student who started the course with minimal Web-based learning skills but managed to improve her skills by using the same training package. She would say encouraging (but not instructional) words such as "Don't worry, it took me a while to get used to searching too!" or "I really like the idea of bookmarking." See sample screenshots in Figure 10.

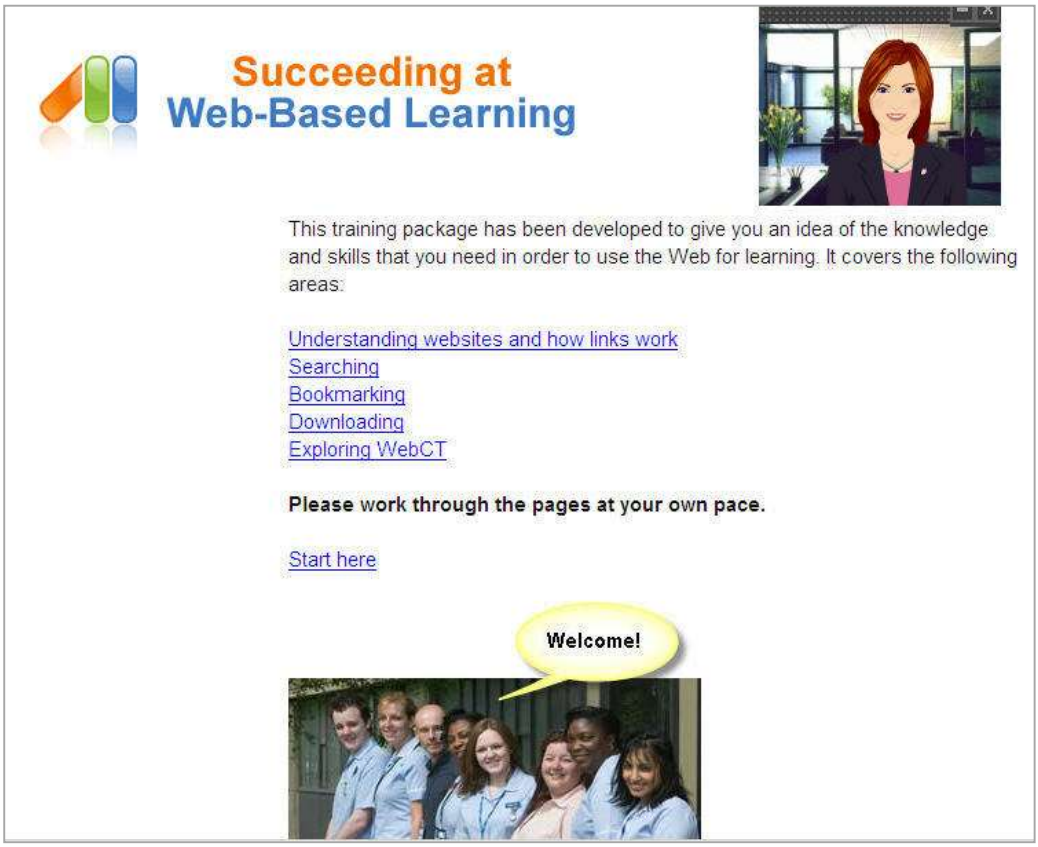


Figure 10. Screenshots of virtual peers

4.6 Measures

The same measures were used in all three studies.

4.6.1 Knowledge and skills multiple choice test

To ensure that the learning materials in the training package were informative, a 12-item multiple-choice test was developed (one correct answer and three distracters) consisting of questions on hyperlinks, searching, downloading, bookmarking, online learning environments and forums. The test was piloted for face validity and clarity with current pre- and post-registration students as part of the User-Centred Design process described in Chapter 3. The full test is presented in Appendix 8. Measuring how much the students have learned was not part of the aim of this research, therefore, the results are not included. For the purpose of this experiment, the multiple-choice test was utilised as a manipulation check.

4.6.2 Web-based learning self-efficacy (WBLSE) measure

A 10-item WBLSE measure was used. This measure was adapted from a validated computer self-efficacy measure developed by Compeau and Higgins (1995b) which attempted to measure individual's judgment of their capability in using computers in general. The WBLSE measure incorporated the elements on encouragement and support by others in the specific domain of using the Web for learning. For example, one of the WBLSE measurement items was "I could do the module and use the websites associated with it ... if I had seen someone else using it before trying it myself". This was measured by its magnitude (the level of task difficulty that a student believed he or she was capable of performing), strength (whether the student could persevere in coping with a more difficult task) and generality (whether the student could generalise his or her beliefs in being able to perform tasks across different Web-based learning situations) (Bandura, 1982b). The full measure is presented in Appendix 9.

4.7 Procedure and Timeline

For Studies 1 and 2, the following procedure was followed. The procedure for Study 3 is described in section 4.10.

The training was delivered to the intervention groups for both studies during the first week of the course prior to students' encounter of WebCT as their Web-based learning environment. The training was carried out over four 90-minute sessions on the same day but at different times in a large computer lab at the University of Nottingham. Each session involved one intervention group undertaking one training package. In addition, there was one non-intervention control group not allocated a training package. Typically, self-directed students

learn from home or on their own. In order to implement this study, self-directed learning was approximated in the computer room and participants were asked to work on their own.

The purpose of the study was explained. All participants completed the knowledge and skills and WBLSE measures before the session.

The facilitator ensured all participants were successfully logged on to WebCT. The control group accessed course materials on WebCT but they did not get the training package and received no additional guidance from the facilitator. Additional explanation was given to the intervention groups regarding the training package they were about to use.

One self-directed group was given the training package without virtual social support and the other with virtual social support. The participants were asked to work through the training package on their own. The facilitator then left the room.

One blended group was given the training package without virtual social support and the other with virtual social support. These groups were encouraged to work through the training package with their peers. The facilitator remained in the room and was on hand to demonstrate the examples in the training packages further and to answer questions.

Headphones were provided for the group with virtual social support. All intervention groups were allowed up to 75 minutes to work through their training package. After 75 minutes, the training was stopped and the knowledge and skills test and WBLSE measure were distributed.

All participants completed the knowledge and skills and WBLSE measures after each session. Sessions on the course timetables were identified where all participants were attending nine weeks after the training session. The WBLSE measure was handed out to all participants to complete again.

4.8 Study 1: Delivery format and social persuasion (post-registration students)

4.8.1 Participants

Participants of the four intervention groups and one control group were 179 University of Nottingham registered nursing students, ranging from age 22 to 58 years (M=36.15). 93% of the participants were female. Students were assigned to condition in (recently and randomly formed) intact classes. The final number of participants who completed all measures at the end of the study was 126. Breakdown of dropouts was 10, 11, 12, 10 and 10 from each group. The delayed test was done on a specific day and withdrawals were based on attendance.

4.8.2 Design

The study employed a 2 by 2 by 3 mixed design. The first factor (delivery format) was between subjects and had two levels (self-directed, blended). The second factor (social support) was between subjects and had two levels (no social persuasion, social persuasion). The final factor (time) was within group and had three levels (pre, post and delayed). In addition a non-intervention group simply took the same tests as the intervention groups but did not use the training package.

4.9 Study 2: Delivery format and social persuasion (pre-registration students)

The design, materials, measures and procedures used in this study were identical with those in Study 1 with post-registration students.

4.9.1 Participants

Participants of the four intervention groups and one control group were 103 University of Nottingham nursing students, ranging in age from 20 to 49 years (M=25.56). 90% of the participants were female. Students were assigned to condition in (recently and randomly formed) intact classes. The final number of participants who completed all measures at delayed test was 83. Breakdown of dropouts was 4, 3, 4, 5 and 4 from each group. The delayed test was done on a specific day and withdrawals were based on attendance.

4.10 Study 3: Virtual peers fidelity

The measures used in this study were identical with those in studies 1 and 2.

4.10.1 Participants

Participants of the two intervention groups and one control group were 131 University of Nottingham nursing students, ranging in age from 18 to 46 years (M=23.46). 86% of the participants were female. Students were assigned to condition in (recently and randomly formed) intact classes. All 131 students completed all measures at delayed test.

4.10.2 Design

The study employed a 3 by 3 mixed design. The first factor (social support) was between subjects and had three levels (high fidelity avatar, low fidelity images and

text, and no images/text group). The second factor (time) was within group and had three levels (pre, post and delayed).

4.10.3 Materials

The revised Succeeding at Web-based Learning training package

The students participating in this follow-up study were also using WebCT throughout their course to access course and learning materials.

The learning materials in the revised version of the Succeeding at Web-based Learning training package were unchanged. However, in order to examine if the avatar and the images/text provided social support in a similar way, the social persuasion objectives were mapped with the balanced presence of the virtual peers. The anthropomorphised avatar, Alison, was present on 8 of the pages (45% of the package) as opposed to only 5 times in the first iteration of the package. The avatar's script was mapped to the images and text low-fidelity persuasive agents to ensure that they exhibited the same social persuasive cues. This mapping is presented in Table 6.

Table 6. Social persuasion mapping

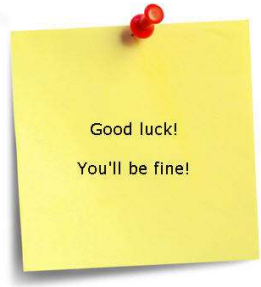
Persuasive objective	**Alison vs** (note: Alison is present 45% of the package)	**Images + Motivational text**	
To ease students into using the training package. To let them know there were previous students who didn't have Web-based learning skills at the start of their course who found the package useful.	**Welcome page** Hi, my name is Alison. I hope you will find this package useful. I did! I am here to share my experience with you and give you some tips and encouragement as you go through the package. You will see me on some of the pages. You can reposition me wherever you want on the page. Good luck! You'll be fine!	**Welcome page** 	**Welcome page** 

Table 6. Social persuasion mapping (continued)

To persuade students that links are not hard to learn.	**Types of links** Links are very important. I find them very easy to use.		**Types of links** 	**Types of links** 

Table 6. Social persuasion mapping (continued)

To persuade students that they can learn to use a search engine – it takes practice (hence searching exercises) but it can be learned.	**Searching page** When I first used Google, I was impressed by the amount of information that's available out there. However, sometimes I still can't find what I'm looking for and I get quite frustrated! Don't worry, it took me a while to get used to it too!		**Searching page** 	**Searching page** 

Table 6. Social persuasion mapping (continued)

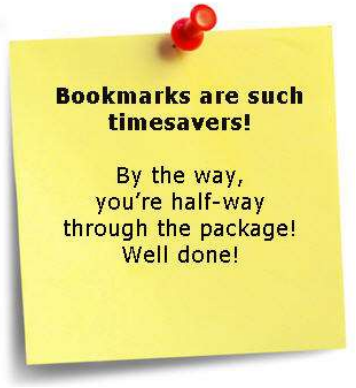
To persuade students that they are able to learn how to bookmark and to organise bookmarks	**Bookmarking page** I really like the idea of bookmarking. Sometimes you come across some really interesting websites that you know you'll come back and visit them again. I get a little carried away with it though! Before I knew it, I had lots and lots of bookmarks in my Favourites! One of these days I'll get on to organising them into different folders. If you've managed to do this in this package, you're one step ahead of me! By the way, you're half-way through the package! Well done!		**Bookmarking page** 	**Bookmarking page** 

Table 6. Social persuasion mapping (continued)

To persuade students that they can learn how to download and give them the skill to find documents that they have downloaded.	**'Downloading' page** I used to get my partner to download my course documentation for me. I never have the time and he makes it look like a doddle. My problem was that I could never find what he downloaded for me afterwards. We only have one computer at home and it's full of his stuff. So I created myself an "Alison's course downloads" folder. I was so pleased when I managed to download the handouts from the WebCT site afterwards. If I could do it, you can do it too!		**'Downloading' page** 	**'Downloading' page** 

Table 6. Social persuasion mapping (continued)

To persuade students that they now have the skills to use WebCT.	**'WebCT' page** The first time I used WebCT, I thought 'where do I start?'. There were lots of links and to be honest I got a bit lost. Learning about links was useful and I was very happy when I found the handouts for the session that I missed!		**'WebCT' page** 	**'WebCT' page** 

Table 6. Social persuasion mapping (continued)

To persuade students that they can use a forum.	**WebCT Discussion Forum page** I liked reading the messages that other people had posted but I was afraid of making a fool of myself because once you've posted something; it's there for everyone to see! But I plucked up the courage and got a thrill to see replies from my colleagues and tutor. It may sound silly but when you're up late at night trying to finish an assignment, seeing messages from people in the same boat as you are is quite motivating!		**WebCT Discussion Forum page** 	**WebCT Discussion Forum page** 

Table 6. Social persuasion mapping (continued)

To persuade students that they now have sufficient knowledge and skills to use the Web for learning	**End page** Well done! I hope you have found the package as useful as I did. It certainly gave me an idea of what I need to do on the Web to get on with the course. Now I don't feel quite as anxious when my tutor says "it's all on the Web"! I wish you all the best with your course. You'll be fine! Goodbye!		**End page** 	**End page** 

4.10.4 Procedure

The training was delivered to the avatar, images/text and no images/text groups during the first week of the course prior to students' encounter of WebCT as their Web-based learning environment. The training was carried out over four 90-minute sessions on the same day but at different times in a large computer lab at the University of Nottingham. Each session involved one group undertaking one training package. Typically, self-directed students learn from home or on their own. In order to implement this study, self-directed learning was approximated in a computer room and participants were asked to work on their own.

The purpose of the study was explained. All participants completed the WBL knowledge and skills test and WBLSE measure before the training session.

The facilitator ensured all participants were successfully logged on to WebCT. The high fidelity avatar group was given the training package with the avatar only as virtual social support. The low fidelity images/text group was given the training package with both images and text as virtual social support. The no images/text control group was given the training package without virtual social support. The participants were asked to work through the training package on their own. The facilitator then left the room.

Headphones were provided for the group with the avatar. All groups were allowed up to 75 minutes to work through their training package. After 75 minutes, the training was stopped and the WBL knowledge and skills test and WBLSE measure were distributed.

All participants completed the WBL knowledge and skills test and WBLSE measure after each session. Sessions on the course timetables were identified

where all participants were attending nine weeks after the training session. The WBLSE measure was handed out to all participants to complete again.

4.11 Data analysis plan

In this quasi-experimental study, the participants were assigned to different conditions. It involved manipulation of the delivery format (independent variable) and the measurement of the effects of this manipulation on the social persuasion dependent variable. In order to answer the research questions, an experimental 2 [self-directed, blended] x 2 [social persuasion, no social persuasion] x 3 mixed pre-test - post-test - delayed test design was used to test the effectiveness of the intervention.

Consequently, statistical analysis was needed to be able to test interactions between these variables. Parametric ANOVA was selected as the most appropriate test as there is no non-parametric test available to test such a design. The main dependent variable which is Likert ratings for WBLSE is ordinal in nature so historically it would have been seen as unsuitable for parametric analysis. However, it is now accepted (for example (Norman, 2010)) that ANOVA is powerful, and robust in these circumstances and should be chosen over non-parametric tests.

4.12 Proposed qualitative component

Focus groups were planned following Study 3 to explore the results further. Five to seven participants from each group were recruited. However, the turnout was poor. In one group only one student turned up. Although the sessions did continue, it was decided that the results could not be used.

4.13 Conclusion

This chapter described the quasi-experimental design used in this research to evaluate the Succeeding in Web-based Learning training intervention in changing WBLSE in nursing students. The study design, sampling strategy, measures, material, procedure and data analysis plan were explained taking into consideration the validity, generalisability and reliability of the study outcomes.

The results from the three studies are presented in the next chapter.

Chapter 5: Results

5.1 Introduction

This chapter presents the results from the three studies conducted as part of this research. Studies 1 and 2 explored if Web-based learning self-efficacy (WBLSE) could be enhanced by a short intervention and if any improvement in self-efficacy was influenced by the format of training delivery and presence of virtual persuasive agents. The third study explored if the fidelity of the virtual persuasive agents affected the improvement of WBLSE.

5.2 Study 1 Post-registration students' WBLSE improvement

5.2.1 Do the nursing students' self-efficacy levels improve as a result of training?

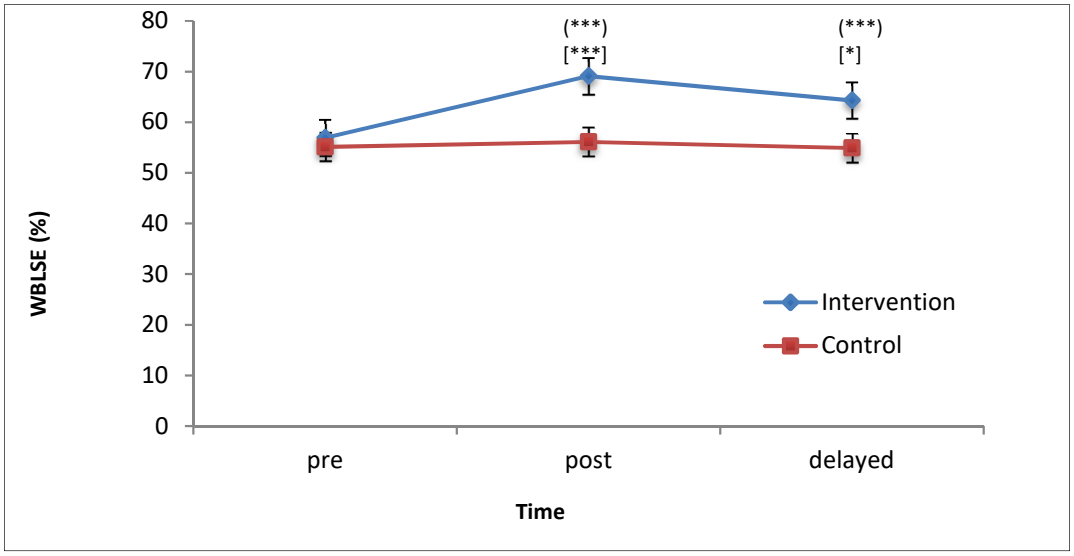


Figure 11. Percentage scores of Web-based learning self-efficacy at pre-test, post-test and delayed test including standard error bars in the study with post-registration students

Note:
** p < .05*
*** p < .01*
**** p < .001*

[ ] denotes significance between groups
( ) denotes significance within groups

Table 7. Percentage scores of Web-based learning self-efficacy at pre-test, post-test and delayed test in the study with post-registration students

	Intervention groups N=100	**Control group** N=26
Pre-test (out of 100%)	56.9 (27.3)	55.1 (30.0)
Post-test (out of 100%)	69.1 (19.5)	56.1 (28.1)
Delayed test (out of 100%)	64.3 (20.6)	54.9 (26.1)

Figure 11 and Table 7 represent the percentage scores of WBLSE at pre-test, post-test and delayed test. To examine the effects of the intervention, a 2 by 3 mixed design ANOVA was carried out on the pre-test, post-test and delayed test data. Analysis revealed a significant effect of time ($F(2,248 = 27.1$, $MSE = 32.9$, $p < .0001$, $_p eta^2 = .179$)) and a non-significant effect of condition ($F(1,124 = 2.4$, $MSE = 1645.0$, $p = .12$, $_p eta^2 = .019$)). The interaction between time and condition ($F(2,248) = 20.1$, $MSE = 32.9$, $p < .0001$, $_p eta^2 = .140$) was significant.

Multiple comparison with Bonferroni corrections showed that there were no differences between the groups at pre-test (mean = 1.80, p = .77), a significant difference at post-test (12.85, p < .008) and a marginal difference by delayed test (9.47, p < .051). Further, the non-intervention group scores did not change over time (pre to post-test = -1.02, p = 1.00; post to delayed = 1.27, p = .30 and pre to delayed test = -.23, p = 1.0) whereas the intervention groups improved significantly from pre to post-test (12.1, p < .0001) and this improvement was maintained to delayed test as their scores did not change between post-test and delayed test (-4.64, p < .0001) and were higher at pre-test (4.64, p < .001). These results showed clearly that post registration students' WBLSE could be improved by training.

5.2.2 Does the format of delivery or presence of social persuasion impact on nursing students' WBLSE?

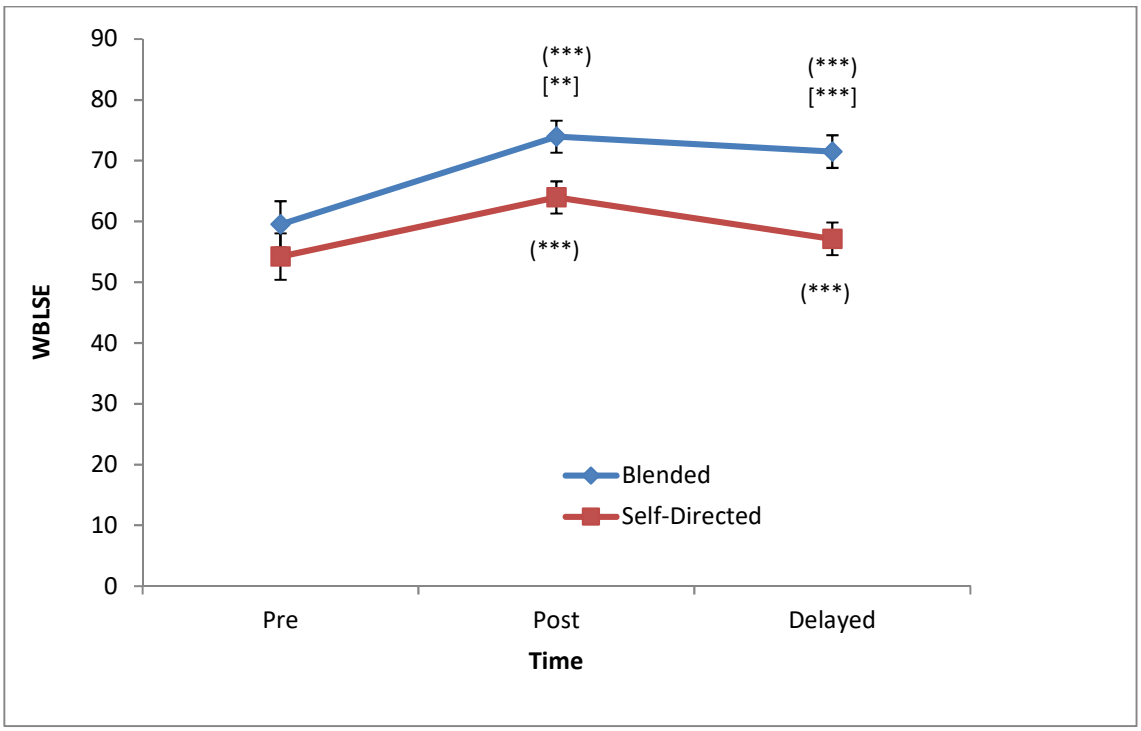


Figure 12. Improvement of Web-based self-efficacy levels at pre-test, post-test and delayed test including standard error bars for the format and social persuasion conditions in the study with post-registration students

Note:

** p < .05*
*** p < .01*
**** p < .001*

[ ] denotes significance between groups
( ) denotes significance within groups

Table 8. Percentage scores of Web-based learning self-efficacy levels at 3 time points for the format and social persuasion conditions in the study with post-registration students

	Blended		**Self-directed**	
	SP N=25	**No SP** N=25	**SP** N=25	**No SP** N=25
Pre-test (out of 100%)	52.3 (25.3)	66.8 (23.9)	52.1 (33.3)	56.4 (24.4)
Post-test (out of 100%)	68.1 (15.0)	80.1 (16.9)	63.2 (22.6)	64.8 (19.3)
Delayed test (out of 100%)	64.6 (13.3)	78.4 (15.5)	56.2 (25.3)	58.0 (19.6)

Table 8 shows the percentage scores of WBLSE at pre-test, post-test and delayed test for the format and social persuasion conditions. Analysis revealed a significant main effect of time ($F(2,196) = 107.0$, $MSE = 35.1$, $p < .0001$, $_{p}eta^2 = .522$) and of format (($F(1,98) = 5.2$, $MSE = 35.1$, $p < .03$, $_{p}eta^2 = .050$). This was modified by a significant interaction between format and time ($F(2,192) = 14.77$, $MSE = 35.1$, $p < .0001$, $_{p}eta^2 = .131$).

Multiple comparison with Bonferroni corrections showed that there were no differences between the self-directed and blended groups at pre-test (mean = 5.3, $p = .33$), a significant difference at post-test (10.0, $p < .01$) and at delayed test (14.36, $p < .0001$). Further, the blended group scores improved over time (pre to post-test mean = 14.4, $p < .0001$; post to delayed test = 2.46, $p < .0001$; pre to delayed test = 12.0, $p < .0001$). The self-directed groups also improved significantly from pre to post-test (9.7, $p < .0001$) and post to delayed test (6.8, $p < .0001$). However, scores from pre to delayed test dropped for the self-directed groups (-2.92, $p = .13$). These results are depicted in Figure 12.

The results showed that post-registration students learning in blended settings with real peers manifested greater WBLSE improvement than the other intervention groups.

5.3 Study 2 Pre-registration students' WBLSE improvement

5.3.1 Do the nursing students' WBLSE levels improve as a result of training?

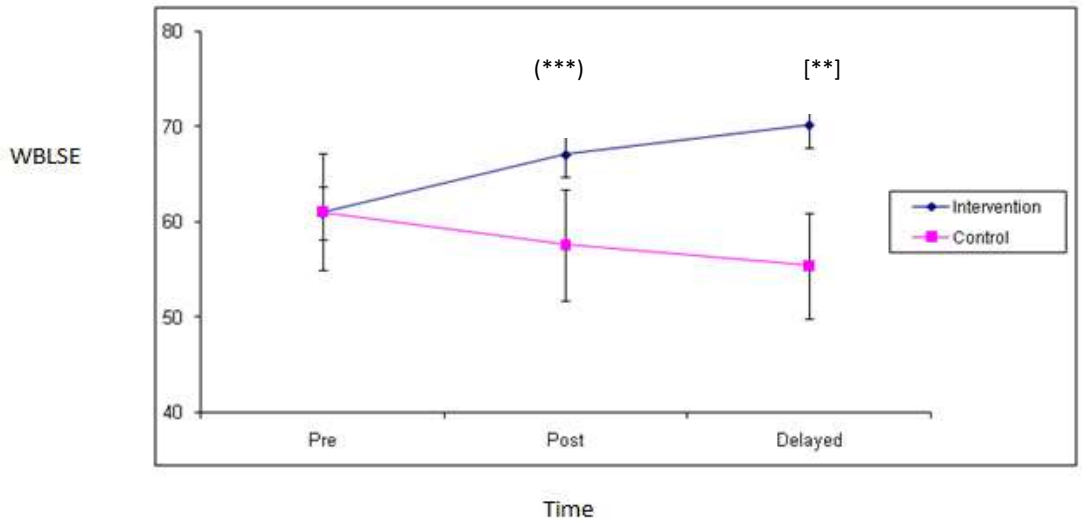


Figure 13. Percentage scores of Web-based learning self-efficacy at pre-test, post-test and delayed test including standard error bars in the study with pre-registration student

Note:

** p < .05*
*** p < .01*
**** p < .001*

[ ] denotes significance between groups
( ) denotes significance within groups

Table 9. Percentage scores of Web-based learning self-efficacy at pre-test, post-test and delayed test

	Intervention groups N=66	**Control group** N=17
Pre-test (out of 100%)	61.0 (22.3)	61.1 (25.4)
Post-test (out of 100%)	67.1 (19.4)	57.6 (24.1)
Delayed test (out of 100%)	70.2 (20.0)	55.4 (22.9)

Figure 13 and Table 9 represent the percentage scores of WBLSE at pre-test, post-test and delayed test. To examine the effects of the intervention, a 2 by 3 mixed design ANOVA was carried out on the pre-test, post-test and delayed test data.

Analysis revealed that the only significant effect was the interaction between time and condition ($F(2,162) = 4.30$, MSE = 178.72, $p < .02$, $_{p}eta^{2} = .05$).

Multiple comparison with Bonferroni corrections showed that there were no differences between the groups at pre-test (mean = .10, p = .99), a marginal difference at post-test (9.47, $p < .091$) and a significant difference by delayed test (14.77, $p < 0.01$). Further, the non-intervention group scores did not change over time (pre to post-test = -3.74, p = .24, pre to delayed test = -5.65, p = .96) whereas the intervention groups improved significantly from pre to post-test (6.11. $p < 0.001$), an effect that was maintained from post-test to delayed test (-3.1, p = 0.74).

The results showed that the pre-registration students' WBLSE improved following the training session.

5.3.2 Does the format of delivery or presence of social persuasion impact on nursing students' WBLSE?



Figure 14. Interaction of social persuasion and delivery format at delayed test – pre-test including standard error bars in the study with pre-registration students

Table 10. Percentage scores of Web-based self-efficacy levels at pre-test, post-test and delayed test for the format and social persuasion conditions in the study with pre-registration students

	Blended		**Self-directed**	
	SP N=14	**No SP** N=17	**SP** N=19	**No SP** N=16
Pre-test	66.0 (21.6)	51.8 (22.2)	65.1 (26.1)	61.4 (16.2)
Post-test	72.4 (21.7)	59.2 (17.8)	70.4 (21.4)	66.8 (14.9)
Delayed test	70.6 (20.4)	66.8 (15.5)	80.0 (14.1)	61.8 (25.5)

Table 10 represents the percentage scores of Web-based self-efficacy levels at 3 time points for the format and social persuasion conditions. Analysis revealed a significant main effect of time ($F(2,125) = 6.26$, MSE = 209.09, $p < .01$, $_{p}eta^2 = .092$) This was modified by a significant three way interaction between format, social persuasion and time ($F(2,124) = 3.88$, MSE = 810.1, $p < .05$, $_{p}eta^2 = .059$).

Improvement scores per subject were calculated (at delayed test – pre-test) and analysed using a 2 x 2 mixed ANOVA with format and social persuasion as factors (Figure 14). This showed a significant interaction between social persuasion and format of delivery ($F(1,62) = 4.01$, MSE = 314.62, $p < .05$, $_{p}eta^2 = .061$). Multiple comparisons with Bonferroni corrections showed that the largest difference between scores was for the self-directed group who learnt with social persuasion support and those who did not, this was close to significance (mean = 14.69, $p = .07$); no further difference approached significance.

The results showed that the presence of virtual support improved the participants' WBLSE learning in self-directed settings without real peers.

5.4 Study 3 Fidelity of virtual peers and WBLSE improvement

5.4.1 Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

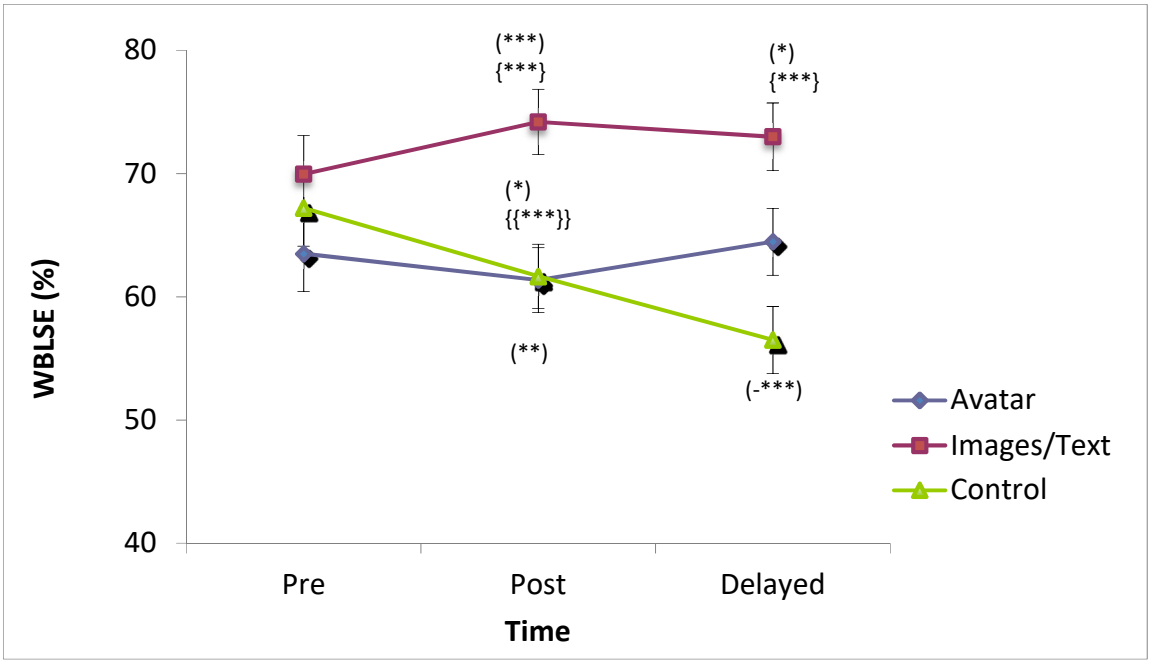


Figure 15. Changes in Web-based learning self-efficacy at pre-test, post-test and delayed test by fidelity including standard error bars

Note:

** p < .05*	*( ) denotes significance within groups*
*** p < .01*	*{} denotes significance between images/text and control groups*
**** p < .001*	*{{}} denotes significance between avatar and images/text groups*

Table 11. Percentage scores of Web-based self-efficacy levels by fidelity at pre-test, post-test and delayed test

	Avatar group N=44	**Images/Text group** N=43	**No images/text group** N=44
Pre-test	63.5 (24.1)	70.1 (18.3)	67.2 (18.3)
Post-test	61.4 (19.1)	74.2 (14.6)	61.7 (18.1)
Delayed test	64.5 (21.3)	73.0 (14.2)	56.5 (17.8)

Figure 15 and Table 11 represent the percentage scores of Web-based learning self-efficacy levels pre-test, post-test and delayed test for all groups. Analysis

revealed a trend for a main effect of time ($F(2,256) = 2.54$, $MSE = 64.3$, $p < .08$, $_p eta^2 = .019$) and a significant main effect of format ($F(2,128) = 4.75$, $MSE = 914.9$, $p < 0.01$, $_p eta^2 = .069$). This was modified by an interaction between format and time ($F(4,256) = 10.95$, $MSE = 64.3$, $p < .0001$, $_p eta^2 = .146$).

Multiple comparison with Bonferroni corrections showed that there were no differences between the avatar, images/text and control groups at pre-test (mean = -3.71, p = 1.0), at post-test (-.30, p = 1) and at delayed test (8.08, p = .12). There were no differences between the images/text and control groups at pre-test (mean = 2.77, p = 1.0), a significant difference at post-test (12.55, p < .003) and at delayed test (16.50, p < .0001). There were no differences between the images/text and avatar groups at pre-test (mean = -6.48, p = .42), a significant difference at post-test (12.85, p < .003) and a marginal difference at delayed test (12.87, p < .09).

Further, the avatar group WBLSE scores decreased from pre to post-test = -2.14, p < .04 but and did not change from post to delayed -3.1, p = .26. However overall they did not end significantly different to the pre to delayed (.98, p = 1.0). The images/text group improved significantly from pre to post-test (4.23. p < 0.0001), stayed stable to delayed test (1.21, p = 1.0), and did not revert to their pre-test levels (3.02, p < .05). The control group WBLSE scores decreased from pre to post test (-5.55, p < .0001), and again from post to delayed (-5.16, p < .012) and consequently were significantly worse at delayed test rather than pre-test (-10.72, p < .0001).

The results showed that the WBLSE level of the students in the no images/text group decreased after the training and again nine weeks later. The WBLSE level

for the avatar group decreased significantly following training but after nine weeks, their WBLSE stabilised to the level before the training. The WBLSE of the students in the images/text group increased following the training session and although it dropped slightly nine weeks later, it did not fall to the same level prior to the intervention.

5.5 Conclusion

This chapter presented the findings from the three studies. The implications of the results on the research questions will be discussed in Chapter 6.

Chapter 6: Discussion

6.1 Introduction

The main aim of this thesis was to explore if virtual persuasive agents can provide social support in the absence of real peers, thereby changing nursing students' Web-based learning self-efficacy (WBLSE).

The questions asked in this research were:

1. Does the nursing students' WBLSE improve as a result of training?
2. Does the format of training delivery impact on nursing students' WBLSE?
3. Does the presence of social persuasion impact on nursing students' WBLSE?
4. Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

A bespoke online training package was developed and used as an intervention for WBLSE in nursing students. This chapter will now analyse the results from the three studies and discuss the implications of the findings in meeting the research objectives.

6.2 Analysis of Study 1 results (post-registration students)

Study 1 was concerned with improving post-registration nursing students' Web-based learning self-efficacy (WBLSE). Students with high WBLSE levels are likely to persist further when performing challenging tasks in the Web-based learning domain. Students with low self-efficacy tend to engage less in challenging task-related activities and they persist less in coping efforts. Furthermore, training has

been suggested as an important means of improving WBLSE (Compeau and Higgins, 1995b, Torkzadeh and Van Dyke, 2002, Nahm and Resnick, 2008).

After training, it was found that the WBLSE level of students in the no intervention group did not change over the study. The WBLSE of students in the experimental conditions, however, increased significantly after a short intervention without follow-up training. Moreover, the students maintained their WBLSE nine weeks later. This long-lasting aspect of WBLSE was an important and encouraging finding from this study – one that recent studies do not investigate (Bates, 2007, Liang, 2010). These studies deployed surveys which asked students to judge their level of computer self-efficacy whereas this study changed self-efficacy levels by developing an interventional training package. According to Bandura (1982b), self-efficacy is a dynamic construct - changes in self-efficacy do not occur as a direct result of having performed specific tasks successfully. The students must personally relate their successful performance with what they need to achieve on their Web-based course. As discussed in Chapter 3, nursing students in particular need to have these transferable basic skills to inform their overall efficient and safe use of information technology in the workplace (Bembridge et al., 2011).

This study also addressed the question whether the presence of social support influenced the development of WBLSE. Bandura's (1977) social cognitive theory suggested that social support is vital to self-efficacy, and influences behaviour through self-efficacy.

Therefore, social support is a key element that contributes to the students' belief that they have the ability to use the Web for learning. In this study, social support was implemented in two ways. In the blended learning condition, real peers and

the tutor were available. In the self-directed learning condition (implemented in a classroom but acting as close to online learning as possible as students sat isolated wearing headphones without the tutor present), peers and tutors were not available to offer this support. Consequently, virtual social persuasion was provided in the form of an avatar (which was supportive and encouraging but did not give instructional messages), happy images of students and encouraging textual messages included in the training package.

Results in this study showed that participants learning in blended settings with real peers manifested greater WBLSE improvement than the other intervention groups. Previous studies reported that while students generally show readiness for learning online (Cragg et al., 2003), students also find learning on their own isolating and they miss the interaction with their peers and tutors (Rovai and Jordan, 2004). The finding from this research showed that virtual peers failed to compensate for real peers. Post-registration students, who are already nurse practitioners, engage much more in teamwork settings and relish the sense of belonging. Virtual peers simply would not add value to their blended learning environment.

This study showed that a short training package addressing the knowledge and skills needed for WBL improved nursing students' understanding. Furthermore, it significantly improved post-registration nursing students' beliefs of their ability to use the Web for learning which were maintained even nine weeks later. Finally, it was shown that this group of students benefited from having the social support from real peers when learning in blended settings.

The nurses who participated in this study were qualified nurses. Due to the nature of the nursing profession, nurses generally undertake CPD on a part-time basis and access Web-based learning for short periods of time either in blended or self-directed settings. It was necessary to carry out a follow-up study with other groups of students to explore if the findings could be generalised. For this purpose, an identical study design was conducted with pre-registration students who were entering nurse education for the first time. Their learning experiences may differ from those of post-registration nurses who are more likely to accommodate self-directed WBL study time while juggling demands from a 3-year full-time course, practice placement and family life. These learners may benefit even more from virtual support. The result from this study is described next.

6.3 Analysis of Study 2 results (pre-registration students)

Similar to the study with post-registration students, it was found that the Web-based learning self-efficacy level of students in the no intervention group did not change over the course of the study. However, the WBLSE of students in the experimental conditions in this study increased significantly after a short intervention without follow-up training. Moreover, they also maintained their WBLSE nine weeks later. Again, this long-lasting aspect of WBLSE is an important finding from this study and it was encouraging that this result was also found in the pre-registration study.

The study also addressed the question whether the presence of social support influenced the development of WBLSE. Results in this study showed that there were no simple effects of the format of training delivery (blended or self-directed)

or of social persuasion (present or absent). Instead, it was found that for participants learning in self-directed settings without real peers, the presence of virtual support improved WBLSE. This differs from findings from the previous study with post-registration students where the participants learning in blended settings with real peers manifested greater WBLSE improvement than the other intervention groups.

It was argued that whilst students generally show readiness for learning online (Cragg et al., 2003), students also find learning on their own isolating and they miss the interaction with their peers and tutors (Rovai and Jordan, 2004). Consequently, the finding that virtual peers can go some way to ameliorate this effect is indeed encouraging and contributes to the potential solution of the lack of social support in self-directed Web-based learning. Moreover, it is consistent with the CASA paradigm (Reeves and Nass, 1996) which purports that learners humanise computer agents and that their mere presence is sufficient to provide social support.

This study showed that a short training package significantly improved nursing students' beliefs of their capability to use the Web for learning, beliefs which were maintained even nine weeks later. Finally, it was shown that the improvement on self-efficacy can be achieved by either learning in blended environments, or when learning alone by having the support of virtual social agents.

In Study 1 and Study 2, two types of virtual social actors were used: a high fidelity avatar and low fidelity happy images and encouraging text. It was the totality of the social support offered by these agents that was investigated. The effects of virtual social persuasion differed in both studies and it was found that students learning in

a self-directed setting benefited from it. It was therefore necessary to explore how the varying fidelities of the virtual peers affected social support for students learning online on their own.

Consequently, the issue of what aspects of virtual peers are most important when providing social support for learners in developing their self-efficacy needs more attention.

6.4 Analysis of Study 3 results (fidelity of virtual peers)

A follow-up study was undertaken to further investigate the impact of virtual peers and whether they provided social support in a similar way. The 'Succeeding at Web-based Learning' training package was further developed to ensure that there was an equal presence of social persuasion for both the high fidelity avatar and low fidelity images/text.

It was found in the previous studies that the presence of virtual peers benefited the pre-registration students who were learning on their own without the company of their peers and tutors. The main question addressed in Study 3 was whether the avatar and the happy images and encouraging textual messages provided social support in a similar way.

Study 3 results showed that the WBLSE level of the students in the no intervention group decreased after the training and again nine weeks later. The WBLSE level for the avatar group decreased significantly following training but after nine weeks, their WBLSE stabilised to the level before the training. The WBLSE of the students in the images/text group increased following the training

session and although it dropped slightly nine weeks later, it did not fall to the same level prior to the intervention. The results imply that even though the avatar provided some social support, the images/text presence provided better support in promoting a more stable and long-lasting WBLSE.

Generally the different fidelities of virtual peers offered some form of social support. This is consistent with the media equation theory (Reeves and Nass, 1996) which holds that people respond to Web-based media as if they were social actors. The virtual peers in this study were designed to have similar characteristics to the nursing students and exhibited appropriate social cues. The findings imply that the students identified with the virtual peers and, therefore, felt socially supported by them. It was particularly encouraging that the simple happy images and encouraging messages in text form were more effective in providing students with the social presence and support necessary to increase WBLSE. Low-fidelity social actors are easier and cheaper to design and implement on Web-based learning environments than the high-fidelity avatars. Therefore, preparing students for Web-based learning and providing support for students learning online in self-directed settings can be easily achieved and with minimal cost and effort. The gains from ensuring that students maintain their beliefs and confidence in using the Web for learning are substantial and have a significant impact on their overall learning experience.

The findings in this study demonstrated that the happy images and encouraging text was more effective than high fidelity agents in providing social support for nursing students learning online on their own and helped improve their Web-based learning self-efficacy.

6.5 Discussion

Three main studies were conducted as part of this research. Study 1 was carried out with post-registration students who demographically were more likely to undertake WBL for short periods of time and posed a more challenged group to prepare for WBL. However, in order to explore if the findings from the study with the post-registration group could be generalised to other nursing student groups, the study was repeated with pre-registration students in Study 2. The two studies specifically addressed the first three research questions:

1. Does the nursing students' WBLSE improve as a result of training?
2. Does the format of training delivery impact on nursing students' WBLSE?
3. Does the presence of social persuasion impact on nursing students' WBLSE?
4. Does the fidelity of the virtual social persuasive agents affect the improvement of nursing students' WBLSE?

A third study was conducted to follow up on the findings from Study 2 with pre-registration students and specifically addressed the fourth research question above.

Overall, the research objectives were achieved. The overarching motivation for conducting this research was to investigate the ways in which nursing students could be prepared for Web-based learning (WBL). The drivers for using WBL in pre-registration and post-registration nursing were discussed in Chapter 2. Preparing novice Web-based nurse learners has been identified as an important step to ensure that nursing students benefit from the advantages of learning online (Song et al., 2004). Although nursing students are generally willing to use the Web for learning and concede that knowing how to search for information would

enhance their ability to apply evidence-based practice (Webster et al., 2003), they also reported that they felt socially isolated when learning online and that they missed the interaction with other students (Rovai and Jordan, 2004). In addition, nursing students who are inexperienced in using the Web for learning may not have the necessary knowledge and skills in accessing the Web to use it for learning. As a result, they may feel anxious about undertaking Web-based courses and will need support (Cazan et al., 2016).

This research explored these concerns further through a preliminary survey with post-registration students and identified perceived WBL knowledge and skills and training needs. 71% (n=304) of the students who participated in the survey wanted some kind of WBL preparation before the start of their course. Even those who perceived themselves as having medium to high Internet knowledge and skills still reported that they would find it useful to be aware of the WBL components of their course prior to course start date "to give me confidence". They commented that this familiarisation was important - 'could have told us prior to registration' that 'WebCT was part of the course'. They further indicated that they would like some support and to have the opportunity to familiarise themselves with the websites that they would be using as part of their course. This is consistent with the findings by other researchers (Atack, 2003, Stokes, 2000, Jonas and Burns, 2010) where students expressed the need for WBL preparation.

A bespoke training package called Succeeding at Web-based Learning was developed as part of this research as a tool for preparing students for WBL. Specific WBL knowledge and skills identified in the preliminary survey informed the learning materials included in the package. However, a training package used to

gain mastery experience of WBL skills only partially addressed the concerns and anxiety that novice Web-based learners have when using the Web for learning. As discussed in Chapter 2, for students to benefit fully from the advantages of WBL, not only do they need the appropriate knowledge and skills, but they also need the social support from their peers and tutors to anchor their beliefs in using the Web for learning, both when learning on their own or with others. Despite the realisation of the consequences of not preparing nursing students for WBL, not least the implications of nurses remaining safe practitioners (as discussed in Chapter 2), few studies address the preparation of nurses for WBL as comprehensively as this research has done. This research has highlighted the role of social support in influencing nursing students' beliefs that they have the capability of undertaking challenging WBL tasks in learning online, thereby increasing their Web-based learning self-efficacy. A summary of the key findings in this research is given in the following section.

Firstly, as described in Chapter 4, it was found that the first iteration of the Succeeding at Web-based Learning training package was effective in increasing Web-based learning self-efficacy (WBLSE) for post-registration and pre-registration students in the intervention groups in Studies 1 and 2. Previous studies suggest that students with high self-efficacy are more likely to persist when faced with challenging WBL tasks and may have a greater chance of success in a given WBL activity (Bandura, 1982b, Olivier and Shapiro, 1993). One of the sources of self-efficacy is mastery experience of the knowledge and skills necessary within a specific domain (Bandura, 1982b). The results in the two studies indicate that giving students the opportunity to successfully complete WBL exercises in a dedicated training session increased their beliefs in using the Web for learning.

The second key finding from this research was that social support played an important role in changing WBLSE for nursing students when learning online with others and on their own. More specifically, it was found in Study 1 that post-registration students' WBLSE increased when learning in a blended setting with real peers. In contrast, the pre-registration students in Study 2 showed the greatest improvement in WBLSE when learning by self-direction supported by virtual persuasive agents. These findings alone have important implications on our understanding of the role of social support in changing WBLSE and how nursing academia can ensure the presence of social support in blended and self-directed Web-based learning.

The findings from Study 2 led to a further follow up in Study 3 which investigated if the different fidelities of virtual peers provided social support in different ways in self-directed settings for pre-registration students. A second iteration of the Succeeding at Web-based learning training package was developed. It was encouraging to find that simple low-fidelity virtual persuasive agents in the form of photographs of happy students and encouraging textual messages provided more effective social support than the high-fidelity avatar. The WBLSE level for pre-registration students who received social support from the low-fidelity virtual peers was more stable than those in the high fidelity avatar group. As discussed in Chapter 2, the Computers as Social Actors theory suggests that people respond to Web-based media as if they were social actors (Reeves and Nass, 1996). This particular finding adds to our understanding that the presence of virtual peers on the Web interface can provide social support in the absence of real peers for students learning online on their own, thereby increasing their WBLSE.

The final key finding from this study was the overall lasting effect of WBLSE following the training sessions. Generally in Studies 1 and 2 the WBLSE for the post-registration and pre-registration students in the intervention groups increased following the training session. More importantly, they also maintained it nine weeks later. In addition, in Study 3, students who received social support from the low-fidelity virtual peers in a self-directed setting also stabilised their WBLSE level after nine weeks. This long-lasting effect of WBLSE provides a strong indication that the combination of knowledge and skills training and social support contributed to the longitudinal stability of students' WBLSE.

These findings will now be discussed further to provide the context and to add to our understanding of how nurses can be prepared for WBL. Limitations of this research will also be given.

6.5.1 Preparing nursing students for Web-based learning by training intervention

The fundamental principle addressed in this study was that it is necessary to prepare nursing students for Web-based learning. In this study a bespoke training package called 'Succeeding at Web-based Learning' was developed to provide students with the necessary knowledge and skills to navigate the websites that they needed to access as part of their course. The training package developed for this study was embedded in WebCT, thereby providing students with the opportunity to familiarise themselves with the virtual learning environment (VLE) before they used it for accessing learning materials and carrying out online activities as part of their course. The training itself was thus conducted in an authentic environment in this research. In reality, academic institutions will continue to explore contemporary online learning tools and VLEs not only due to changes in internal

policies but also commercial constraints and continued availability of current systems. The IT infrastructure that supports VLEs and online learning systems continues to develop and it may be that new VLEs and e-learning systems need to be considered for reasons of cost, support and scalability. For example, at the time of writing this report, a new VLE to replace WebCT, Moodle, is in the process of being rolled out to all University of Nottingham courses including pre-registration and post-registration nursing courses. Further iterations of the training package will need to be hosted on the Moodle VLE to remove the element of 'shock' and reduce the feeling of anxiety in 'not knowing what to expect' on a Web-based course.

The training package was developed as a Web-based package rather than a paper-based guide in order to incorporate the virtual social support elements. In addition, delivering the training in a paper format may not have given the students the hands-on opportunity to gain the mastery experience of the WBL knowledge and skills. For example, reading the instructions about how to download their module handbooks and not actually carrying out the activity online would not have given them the experience of successfully downloading a course document. As discussed in Chapter 2, learning the essential practice knowledge and skills by watching others perform the activities forms an important part of nurse education. For example, measuring blood pressure is a basic essential skill that nursing students need to master in order to achieve their practice competencies. They initially learn this practical skill by watching a demonstration by their tutor or mentor. Students may also be able to learn this skill from reading step-by-step instructions on how to find and listen for the pulse correctly and safely but without the opportunity to practise the skill, they may not have the experience in completing the activity

successfully. As a result they may not have the confidence in performing this skill in real ward-based situations.

Other studies such as Cragg et al. (2004) used a combination of approaches in preparing students for WBL. Cragg et al. (2004) developed a whole suite of support mechanisms including face-to-face training, off- and online guides and helpdesk support. While this is comprehensive, it could be viewed as a 'fire-fighting' approach and was done without fully understanding the student needs. In this study, the User Centred Design (UCD) approach (Abras et al., 2004) was taken to involve students in the process of developing the training package. This approach was used to ensure that the content of the training package was developed through real insights and user requirements and not institutional or developer intuition.

The UCD approach also allowed for different user personas to be developed to inform the content development of the training package. In this research, a preliminary survey was distributed to post-registration students who were most likely to use the Web for learning in self-directed settings. Based on the survey results, it was possible to develop user personas for all potential users of the training package namely pre-registration and post-registration students. Because the focus of this research was on the effects of virtual persuasive agents in changing WBLSE, this approach was appropriate.

In addition, although the UCD approach was recommended by other studies (Bødker, 2000, Wichansky, 2000), in reality it may not be possible to incorporate all of the UCD steps into the development process due to time, resource and cost constraints. In addition, instructions and guidelines for use of University Web-

based systems such as WebCT are often produced at institutional level. Academics and learning technologists are obliged to distribute these documents to students before they start their course. The results from this study could therefore be used to inform current University practice in supporting students and in preparing them for Web-based learning.

The knowledge and skills included in the training package were: demonstrating a general understanding of how websites work, bookmarking Web pages, downloading files from websites, searching for information and exploring the online learning environment. These were identified based on feedback from students in the preliminary study. As discussed in Chapter 3, few studies reported a definitive list of knowledge and skills necessary for WBL. This could be due to the overlap with general IT literacy. For example, file management skills are called upon when downloading and saving an online document into a local computer drive for easy retrieval at a later date. The knowledge and skills taught in this training package are arguably basic. However, due to the differing ranges of skills and varied backgrounds of nursing students, it was necessary to include the basic concepts of how websites work, for example familiarity with hyperlinks. This forms the foundation of all Web-based activities, for example searching for information and bookmarking Web pages. Having acquired the basic WBL concepts, students will be able to apply the knowledge and skills to other online activities such as exploring other websites that they will be using in their current and future courses. They may also be able to apply these skills at work to look for information relating to providing evidence-based patient care. In other words, students can relate the mastery experience they underwent during the training to online activities beyond the short session or even the course.

The knowledge and skills exercises in the training package were contextualised to the outcomes that students expected when accomplishing tasks required as part of their Web-based course. In other words, the training materials were real tasks (for example downloading a module handbook and posting a message to a discussion forum) as opposed to training about using the computer or a particular browser (Ortiz de Guinea and Webster, 2011).

Because this study focussed on the specific domain of Web-based learning, students' prior experience in using computers generally has not been included in this research. As discussed in Chapter 3, although there are overlaps between computer and Web-based learning knowledge and skills, students use computer applications to meet varying purposes. For example, students may have the confidence to use a word processing or a database application and yet may feel anxious about using the Web for learning. This decision was consistent with the domain-specific self-efficacy framework that informed this research.

6.5.2 Preparing nursing students for Web-based learning by improving their Web-based learning self-efficacy

In Studies 1 and 2, it was shown that students' Web-based learning self-efficacy (WBLSE) generally increased following a short training session regardless of the format of training delivery. Extrapolating from previous research on self-efficacy (Beas and Salanova, 2006, Marakas et al., 2007), it might be expected that students with high WBLSE levels would be likely to persist further when performing challenging tasks in the Web-based learning domain. Students with low self-efficacy tend to engage less in challenging task-related activities and they persist less in coping efforts (Bandura, 1982b).

Furthermore, training has been suggested as an important means of improving computer self-efficacy (Chou, 2001, Compeau and Higgins, 1995a). It was therefore encouraging to find that the short training developed in this research was effective in changing WBLSE.

6.5.2.1 Role of social support in changing Web-based learning self-efficacy

The main question addressed in this study was whether the presence of social support, which is one of the sources of self-efficacy, influenced the development of WBLSE when students were learning online on their own or with others. Students undertaking Web-based learning with their peers in a blended learning setting could gain social support from others (social persuasion) and learn with them (vicarious learning). In contrast, lone students who are new to learning online in self-directed settings may not have the necessary knowledge and skills to carry out the required online course activities. As a result, they feel anxious, isolated and may give up and even drop out from the course. The presence or absence of social support was explored in this research as part of the training in preparing nursing students for Web-based learning. In the absence of real peers, virtual persuasive agents were included instead to examine their capability in providing social support.

The results in Study 1 showed that post-registration students found support from real peers more advantageous. In other words, the virtual peers failed to fully compensate for real peers. The encouraging messages that virtual peers communicated might have not been as credible as spoken words from real peers (Murphy, 2001). For example, the students might have not been able to identify with the virtual peers because real peers could offer more personal and meaningful

messages through eye contact and body language whereas the avatar was a static presence. In addition, real peers are able to make a judgement on how anxious a person or colleague is and can offer encouragement as appropriate.

In contrast, the pre-registration nursing students learning online on their own benefited from social persuasion provided by virtual peers. This suggests that the students might have identified with the virtual peers and found the encouraging messages from the virtual peers credible.

This is an important contribution to our understanding of Web-based learning and how novice Web-based nurse learners in different stages of their professional career can be prepared for learning in a non-traditional way. As discussed in Chapter 2, pre-registration and post-registration students differ in demographics and course experiences. Pre-registration students who generally undertake a full-time 3-year course are more likely to access WBL more often and on their own for longer periods of time. For example when away on practice placement, they may learn online on their own to catch up on theory work or prepare for course assessments but have more opportunity to establish links with peers and gain peer support.

Post-registration nursing students, who are already nurse practitioners, engage much more in teamwork and relish the sense of belonging. Virtual peers simply would not add value to their blended learning environment although they may have less opportunity to contact student peers for support.

However, it was encouraging to find that social support played a part in changing WBLSE for both pre-registration and post-registration students. More

importantly, in the absence of real peers, virtual peers can be used and incorporated into WBL preparation to generate social support.

6.5.2.2 Virtual persuasive agents providing social support for Web-based learning self-efficacy

As discussed above, the pre-registration students in Study 2 benefited from social support provided by virtual peers when learning on their own. This showed that virtual peers can provide social support in the absence of real peers. Study 3 further investigated if the different fidelities of virtual peers provided social support in the same way in self-directed settings.

Virtual social persuasion in Study 3 was provided in the form of a high fidelity avatar (which was supportive and encouraging but did not give instructional messages) and lower fidelity happy images of students and encouraging textual messages included in the training package. It was found that students who did the training with social support improved their WBL knowledge and skills whereas the students who were trained without social support did not. This result suggests that social persuasion in the form of positive encouragement and support provided by virtual peers resulted in successful mastery experience of the WBL knowledge and skills and promoted positive physiological states. This further suggests that to change WBLSE, the four sources of self-efficacy discussed in Chapter 2 as posited by Bandura (1982b) need to be present when students are learning online on their own.

More importantly, it was found that the WBLSE level of the students learning without social support decreased after the training and again nine weeks later. This suggests that without any form of social support, inexperienced Web-based nurse learners in a self-directed setting may feel more and more anxious over time in

using the Web for learning. If this is true, the learning experience for students who learn online alone would be substantially compromised if social support were not available. It was therefore encouraging to find in this research that the presence of virtual peers compensated for the absence of real peers. Furthermore, the results imply that even though high and low fidelity virtual peers provided social support generally, the social presence of simple images of happy students and encouraging text provided better support in promoting a more stable and long-lasting WBLSE.

This result is consistent with the Computers as Social Actors theory (Reeves and Nass, 1996) which suggests that people treat Web-based media as if they were social actors. However, this study extended this paradigm further and explored the role of social actors in providing social support for increasing Web-based learning self-efficacy for students in self-directed settings and if the different fidelities of virtual peers provided social support in a similar way.

As discussed in Chapter 2, numerous studies have investigated high-fidelity avatars from the technological and education perspectives. It was found in Study 3 that even though the high fidelity avatar, Alison, did provide a social presence, the social support that students gained from her was not as effective as that from the low-fidelity peers. Previous studies reported that the characteristics that are important in avatars include credibility (Mayer et al., 2003), the perceived honesty of the source of the message (Jones, 2007), similarity between the influencing agent and people it persuades and speech characteristics (Nass, 2001). In this study, Alison's synthesised voice was possibly too 'wooden', unnatural and distracting. As part of the training package, she was programmed to 'speak' automatically on the pages she appeared. Students were not able to switch her off

and did not have the option not to listen to her. Students may have considered her as 'pushy' and 'in your face' and failed to compensate for real peers in providing social support. In contrast, the static images and text were more subtle and provided a 'peripheral persuasion' (Fujinami and Riekki, 2008) which was more effective and easier to identify with as the students in the images were in similar uniform and surroundings as the student nurses taking the course.

If this explanation is correct, it suggests that in order to explore the possibility of routine use of high-fidelity avatars to provide social support, the current text-to-speech (TTS) technology needs to improve further. Many systems currently in use by the general public exhibit lapses in pronunciation accuracy, fluctuate somewhat in speech rate and rhythm, and sound less natural and less emotive than human speech (Nass, 2001). Stern, Mullennix, Dyson, & Wilson (1999) studied the degree to which synthetic speech is perceived as 'persuasive' by comparing high-quality speech produced from a commercially available TTS system with both a lower quality TTS system and natural human speech. Listeners rated human speech as softer, higher pitched, less accented, less lengthy, less nasal, and livelier than synthetic speech. They also rated the human speaker as more knowledgeable, more truthful, more involved, but less powerful than the TTS 'speaker'. Even though there is little evidence to suggest that there are differences between natural human speech and synthetic TTS speech in degree of persuasiveness, findings from this study suggest that the students did not attribute sufficient personal qualities to the avatar. In other words, even though students may have identified with the message (words) that Alison uttered, they did not consider her as 'one of them' and did not feel socially supported by her. Her message, though worded to offer encouragement, failed to be credible and promote trust.

Alison was designed to match the nursing students' demographical characteristics in terms of gender and professional look. She was also designed to look friendly and approachable. Even though she had these characteristics, it appeared that the nursing students failed to identify with her.

In this respect, the finding from this study was somewhat in contrast with the media equation theory and the fact that students did not consider the high fidelity avatar as a social actor. However, the finding from this study was similar to the results from Veletsianos' (2012, p.279) study of non-task comments versus on-task comments by instructional avatars. He found that *"on-task interactions are efficient, but impersonal; non-task interactions are memorable but distracting and 'fake'"*. Although his study participants applied human qualities to the avatar ("she's petite"), they found her unsettling when she portrayed human behaviours (moving her head) or said 'normal' non-tasks comments ("my cousin spends way too much time on video games").

In summary, the nursing students benefited more from the social support provided by the low-fidelity social persuasive tools. This is consistent with the CASA theory which holds that people respond to simple Web-based media as if they were social actors. It was encouraging that the simple happy images and encouraging messages in text form were sufficient to provide students with the social presence and support necessary to increase WBLSE. This has important implications on how students can be prepared for Web-based learning in a self-directed setting.

6.5.3 Long-lasting effect of Web-based learning self-efficacy

Few studies have explored the changing or long-lasting aspect of self-efficacy in general and even less research has been done to investigate this within the Web-based learning domain. In this study, a validated computer self-efficacy measure developed by Compeau & Higgins (1995b) was adapted from the general aspects of computer self-efficacy to focus on specific issues of using the Web for learning. This tool was used in three separate studies to measure the changes of Web-based learning self-efficacy at three points in time. It was found that the WBLSE of students in the no intervention groups in Studies 1 and 2 did not change over the study period. However, the WBLSE of students in the experimental conditions in both studies increased significantly after a short intervention without follow-up training. Moreover, these students maintained their WBLSE nine weeks later. The students in this and other studies (Atack, 2003, Melincavage, 2011) reported that they felt anxious about starting a Web-based course. Results from this study showed that students' WBLSE can be increased and maintained even with only a short intervention. In addition, it was found in Study 3 that low fidelity virtual peers provided better social support in stabilising WBLSE level for pre-registration students learning online in self-directed settings. Overall, this research showed that a short training session could maintain and stabilise students' WBLSE in using the Web for learning. This is an important and encouraging finding and contributes to our understanding of changing nursing students' beliefs in their ability to use the Web for learning.

6.6 Limitations of this study

Having completed the study, the aim and objectives of this research are considered to have been adequately met and that this study has highlighted a few important findings. However, some limitations have also been identified and recommendations for further research are given.

The training sessions in this study were scheduled as part of students' course timetables during the first week of their course. The training sessions were conducted in a computer room where students accessed the training package in the presence of their peers. As discussed in Chapter 2, students access WBL either with others or on their own. In this study, the training environment for the self-directed group was an approximation of how students access WBL on their own. The training sessions for the self-directed condition in the three studies were implemented in a classroom emulating self-directed learning as closely as possible as students sat isolated wearing headphones without a tutor present. In real life, self-directed WBL does not necessarily involve students sitting in a computer room. They will most likely be carrying out WBL activities in their homes or work environments. However, even at home or at work students may not be learning on their own. They could still call upon family members, friends or colleagues for help. Nevertheless future studies could explore the possibility of distributing the package to students prior to course start dates in order that students can access it in their own environments at home or at work.

This research has provided a starting point for preparing nursing students for Web-based learning in the context of changing their Web-based learning self-efficacy. The training package was developed to deliver an introduction to Web-

based learning knowledge and skills. In this research, it was delivered to students in either a blended or self-directed format. However, it would be useful to explore other ways for introducing the Web-based learning knowledge and skills to novice Web-based learners. For instance initially presenting it to them in a blended learning setting followed by self-directed learning may have been more effective.

In addition, this research provided a context for preparing students for Web-based learning in nurse education and only focused on preparing nursing students in learning online. It would be desirable to find out if the results in this research could be generalised to student groups other than nursing students. For instance, other healthcare students such as midwifery or physiotherapy students might benefit from an adaptation of the Succeeding at Web-based Learning training package for WBL preparation in various stages of their courses and career. In addition, in order for the contributions from this research to be generalised further, conducting the studies further afield in non-healthcare education would be useful.

This study was conducted using a quasi-experimental design. As discussed in Chapter 4, even though RCTs are considered the ideal standard for carrying out an experimental design, carrying out research in the 'real world' with 'real' people means that it is not always possible or realistic to allocate participants randomly to conditions. However the research design was the most appropriate given the topic being investigated.

In this study, the participants were assigned to different conditions. It involved manipulation of the delivery format (independent variable) and the measurement of the effects of this manipulation on the social persuasion dependent variable. In

order to answer the research questions, an experimental 2 [self-directed, blended] x 2 [social persuasion, no social persuasion] x 3 mixed pre-test - post-test - delayed test design was used to test the effectiveness of the intervention.

Consequently, statistical analysis was needed to be able to test interactions between these variables. Parametric ANOVA was selected as the most appropriate test as there is no non-parametric test available to test such a design.

The findings in this research were all derived as quantitative data and therefore lack the qualitative and rich description that data collected through focus groups or interviews may have provided. As part of this research, attempts were made to follow up the training sessions with focus groups. However, even though the research managed to attract sufficient numbers of volunteers from the participant groups, many did not turn up to the arranged focus group sessions. This was probably due to timings of the sessions which were held after the delayed tests for each condition. Qualitative follow up studies with participants from each training group in Study 3 might have helped to explain why the high fidelity avatar was not as effective as the lower fidelity images and text were in providing social support.

The preliminary survey was carried out with post-registration students who demographically were more likely to undertake WBL for short periods of time on a part-time basis and posed a more challenged group to prepare for WBL. Post-registration students were chosen on the basis they may have not undertaken continuing professional development courses at a higher education institution before or for a while. It is acknowledged that although pre-registration students attend their courses on a full-time basis, they may have had different requirements. However, in the School of Nursing where this study was conducted, pre-

registration students accessed the same WebCT virtual learning environment and all modules in WebCT followed the same basic template for each module. It can be argued that the activities that pre-registration students undertake as part of WBL would be similar to those that post-registration would undertake. In addition, the training package content included WBL tasks such as bookmarking and searching that have been reported by other researchers as common Web skills.

Because this study focussed on the use of virtual social persuasion to change self-efficacy in the specific domain of Web-based learning, students' prior experience in using computers generally has not been included in this research. As discussed in Chapter 1, although there are overlaps between computer and Web-based learning knowledge and skills, students use computer applications to meet varying purposes. For example, students may have the confidence to use a word processing or a database application and yet may feel anxious about using the Web for learning. This decision was consistent with the domain-specific self-efficacy framework that informed this research. However, prior experience was included as part of the User-centred Design preliminary survey.

6.7 Conclusion

The findings from the three main studies conducted as part of this research were analysed and discussed in relation to the research aims and objectives. Limitations of this research were also given.

Implications on the field of WBLSE in nurse education, research and practice and recommendations for further studies are outlined in the next chapter.

Chapter 7: Conclusion

7.1 Introduction

This study has provided unique insights into how virtual peers can provide social support in changing Web-based learning self-efficacy, thus offering further understanding into the development of online materials.

This chapter will revisit the research objectives that guided the conduct of this study. This chapter will also link the findings from the study to the broader context of Web-based learning, identify their wider implications in nurse education and practice and propose some recommendations for implementing these results in a practical context. The chapter concludes with suggestions for further research and a closing word.

7.2 Revisiting the research objectives

This study had three main objectives:

1. To investigate if a short training session can increase nursing students' self-efficacy in using the Web for learning.

2. To explore if the presence of virtual peers such as avatars, images and text can compensate for the absence of real peers in improving Web-based learning self-efficacy in nursing students.

3. To examine if virtual peers of different fidelities provide social support in a similar way.

As demonstrated in Chapters 5 and 6, these aims were achieved. To my knowledge, this is the first study that attempted to investigate if Web-based learning self-efficacy can be changed by utilising virtual peers to provide social support.

7.2 Implications, recommendations and future research

7.2.1 Web-based learning

In future iterations of the training package, the learning materials could be extended to include other typical WBL activities such as sharing a website link or attaching a file or an image to a discussion forum post. Students may also be given the opportunity to take control of their online learning environment through personalisation of their virtual learning environment by adding their own resources or bookmarks, thus encouraging them to become a more confident Web-based learner. As mentioned earlier, education providers are continually exploring the pedagogical suitability of Web-based learning tools and virtual learning environments. For example, students may need to utilise social networking websites such as Facebook and Twitter or collaborative cloud technology such as GoogleDocs or Prezi as part of Web-based learning. Thus, the basic knowledge and skills covered in the training package give students the tools that they need to navigate around various websites, search for information, bookmark Web pages, download any relevant documents and post a message on online forums or comment on other people's statuses on social media sites.

This study has highlighted that in order to measure self-efficacy in the way that Bandura (1982b) suggested, an intervention to change self-efficacy is needed.

Various validated self-efficacy measures exist (Compeau and Higgins, 1995a, Kinzie et al., 1994) to measure people's beliefs of being able to use a computer or the Internet generally. Whilst the measures are an important tool to give an indication of people's self-efficacy, the results remain largely self-reported. In order that the strength of beliefs in carrying out an action within a specific domain can be verified and generalised, intervening for self-efficacy is important. As discussed in Chapter 2, self-efficacy is a dynamic construct and changes over time as students learn (or do not) about a specific domain, and is affected by the influence and support of people around the individual and his or her experience of mastery of an activity. If the intention is to change self-efficacy, simply measuring it will not change it. The WBLSE measure in this study was distributed immediately before and after the training session. Students' WBLSE was measured again nine weeks after the training. This study found that following the intervention, students' increased WBLSE following the training session was generally maintained nine weeks later. In order to explore if their ability in using the Web for learning changes after a longer period of time, it would be useful to apply the WBLSE measure again at a later point. For example, the WBLSE of post-registration students who return to undertake another CPD module six months later may have changed. In the case of pre-registration students, a follow-up WBLSE measure could be undertaken at the beginning of subsequent academic years. These students would have more opportunities to use the Web for learning in their 3-year course. To test the longitudinal effectiveness of the intervention further, it would be informative to investigate if pre-registration students' WBLSE has changed after a year. Moreover, even though Bandura (1982b) advocates that self-efficacy should only be measured in a specific domain, it would be interesting

to explore if students' WBLSE influenced their general self-efficacy in overall course performance.

In this study, an alternative way for providing social support for students who were learning online on their own was needed. The CASA theory (Reeves and Nass, 1996) which suggests that people respond to elements on a Web interface as if they were social actors fitted in well with the research objectives for this study. The students who participated in Study 3 responded well to low fidelity social actors and felt supported by them when they were learning in a self-directed setting. This finding extended the CASA theory and showed that low fidelity virtual peers in the form of simple images and text could provide social support which contributed to the increase or stability of WBLSE for students learning online on their own. Future iterations of the training package could therefore be developed to include knowledge and skills learning materials appropriate to the required level and objectives of WBL preparation. It is recommended that photographs and text are included to provide social support for pre-registration students who will be using the training package in self-directed settings. Overall, this study suggests that adding images and text is an effective way of encouraging self-efficacy. As this costs little to develop, it seems prudent to recommend it. However, to emulate the social persuasion in blended settings, it is perhaps useful to include tools to facilitate online interaction, for example online chat and discussion forums. In order that students fully benefit from WBL preparation, a time to use the package could be scheduled so that even if students access it on their own there are real peers available.

The findings in this research are based on WBLSE measured in the context of formal learning as part of traditional University nursing courses. In online distance learning courses where by definition students will be learning on their own, the inclusion of virtual social support into learning materials may be beneficial.

In the broader area of WBL, the findings in this research could inform the development of informal learning websites such as the Massively Open Online Courses (MOOCs) which seek to provide interactive and dynamic learning materials to hundreds of thousands of users via the Web (Little, 2013). Most MOOCs feature shorter, more focused lectures, regular quizzes and assignments, and opportunities, via video, to chat with classmates. It is perhaps too soon to know the extent to which these efforts in open, interactive learning will make a difference to educational processes and practice but as Web infrastructure continues to improve and as we gain more understanding of the delivery of online learning, it is likely that use of the Web for learning will advance further.

7.2.2 Nurse education and practice

This study has highlighted important considerations for teaching, practice and research in nurse education. It has been shown that preparing novice Web-based learners to learn online is important in order to ensure that nursing students know what to expect when learning in this way. Failing to do this will result in anxious students who may wrongly perceive that they do not have the capability to learn online. Their performance on their course generally may suffer and in some cases, may lead to attrition from the course. This is not economical and is educationally undesirable for the students and nursing educators alike. In the case of the post-registration students, this perception may affect their continuing professional

development plan and their career stability. There may be cost implications for the students' employers in practice in initially releasing the students and funding their continuing professional development (CPD) course, but the real impact will be on patient care. The nurses may find other methods for fulfilling their CPD requirements but if they avoid Web-based courses because they do not feel confident in using the Web for learning, this may also affect their ability to use online systems in practice. This implication has a direct impact on their capability to remain a safe practitioner.

The lack of WBL preparation for nursing students also has implications on nurse educators. Developing a Web-based course requires additional time commitment from academics and learning technologists. WBL is not just a matter of converting paper-based learning resources to a Web-based format ('textbook on the Web') but must be appropriately designed to support the intended learning pedagogy (Cook, 2007). WBL courses need to be explicitly designed to recognise and respond appropriately to learning needs and can incur large initial costs to develop. In addition, ongoing teacher time in monitoring communication tools such as online discussion forums can be significant. If students do not reap the full benefits from Web-based courses because of lack of preparation, the time and effort invested in developing the resources will be largely wasted.

The students who participated in this research largely benefited from the training session to prepare them for Web-based learning. Pre-registration students learning by self-direction in particular needed social support. This implies that WBL preparation is an important activity that nurse education providers need to consider as part of the development and deployment of Web-based courses.

Previous studies have also identified training as a mechanism for preparing students for WBL. In this respect, this study merely adds to others' recommendations. However, this research has also explored the consequences for not including social support in preparing nursing students for WBL in detail. This finding implies that, if no WBL preparation is done, students who do not have the ability to use the Web for learning at the start of the course may continue to lack confidence in learning online throughout their course. At university and in practice, more opportunities are available to undertake online learning, some of which is mandatory for nursing students to access. If support from peers or tutors is not available to students, they may find a 'workaround' to avoid accessing the VLE or other websites related to their course.

In times when technology has become embedded in our daily lives and society is connected to online information 24 hours a day, Web-based learning tools and technologies will also progress. The uptake of WBL in nurse education is likely to increase in the future driven by government policies and higher education strategies, particularly in a climate of increased inter-professional education initiatives, a constant shortage of qualified nursing staff, and increased financial constraints both in health and education. Indeed, the demographics of nursing students may change as nursing students join the NMC register having completed the pre-registration degree exit curriculum. As a result, as the healthcare workforce becomes more familiar with WBL, the requirements for WBL intervention in the future may evolve to include more specific and advanced WBL technologies such as social media tools.

7.3 Closing word

This thesis investigated if virtual persuasive agents could provide social support to students in the absence of real peers, thereby changing their Web-based learning self-efficacy. This research also explored if nursing students' Web-based learning self-efficacy could be improved after undertaking a brief training session alone or with others and if the fidelity of virtual peers had an impact on Web-based learning self-efficacy.

The stance in the overall research was that it is important to prepare nursing students for Web-based learning to ensure that they gain the benefits from learning online either on their own or with others. The preparation needs to be effective so that students' confidence in using the Web for learning is maintained in order that they have the capability to use any website for learning purposes in academic and practice settings. The training package developed in this study was found to be an effective mechanism for increasing nursing students' self-efficacy levels to anchor their beliefs in their capability in using the Web for learning. It was found that not only can Web-based learning self-efficacy be increased; it can also be maintained. This long-lasting effect of Web-based learning self-efficacy provides a strong indication that the combination of knowledge and skills training and social support contributed to the longitudinal stability of students' beliefs in their capability in using the Web for learning. More importantly, it was found that in the absence of real peers, low fidelity virtual peers could provide social support.

This research achieved its aim as a whole. It has offered important contributions to the fields of Web-based learning in nurse education as follows:

- contributed to our understanding of how nursing students could be prepared for Web-based learning through a brief training session

- the development of training packages could be adapted to improve Web-based learning knowledge and skills and change nursing students' Web-based learning self-efficacy

- contributed to the understanding of the role of social support in changing Web-based learning self-efficacy for students learning online with others or on their own

- an evaluation of virtual persuasive agents to provide social support in the absence of real peers

In the context of nurse education and practice, the findings in this research contributed to our understanding of how Web-based learning self-efficacy can benefit nurses to become safer practitioners. In view of the current economic climate and directives from the government and higher education to utilise Web-based learning technologies for delivering nurse education, the findings of this research have provided nursing educators with a starting point for effectively preparing nursing students for Web-based learning.

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Appendices

Appendix 1: Preliminary Survey

Survey of Post-Registration Nursing Students' Attitudes to Web-Based Learning

Background

1. Sex:

☐ Male ☐ Female

2. Age:

☐ years

3. Please indicate if you are a:

☐ Nurse
☐ Theatre practitioner
☐ Other (please specify) ☐

4. In total, how many years have you worked in your current job:

☐ year(s) ☐ month(s)

5. Have you successfully completed a qualification to become a registered nurse?

☐ No (Skip to 9) ☐ Yes

6. Where and when did you complete your qualification to become a registered nurse?

Institution:	
Country:	
Year of completion:	

7. What is the qualification that you have to become a registered nurse? *Tick all that apply.*

- ☐ Certificate
- ☐ Diploma
- ☐ Degree
- ☐ Postgraduate Diploma
- ☐ Masters
- ☐ Other (please specify) _____

8. What is the title of the qualification(s) that you have?

_____

9. Do you have other qualifications (including non-nursing)?

- ☐ No
- ☐ Yes (please specify) _____

10. On the Learning Beyond Registration course, are you studying for a

- ☐ Stand alone module
- ☐ Diploma
- ☐ Degree
- ☐ Undecided

11. Is your study funded by

- ☐ Your employer
- ☐ Self
- ☐ Other Please specify: _____

12. Which Learning Beyond Registration pathway/area are you studying?

☐	Not applicable	☐	Operating Department Practice
☐	Cancer and Palliative Care	☐	Orthopaedic
☐	Child Healthcare	☐	Primary Care
☐	Critical Care	☐	Sexual Health
☐	Gastroenterology	☐	Tissue Viability
☐	Head and Neck Care	☐	Combined Studies
☐	Healthcare for Older People	☐	Other (please specify)
☐	Mental Health		

13. Which of the following reasons have contributed to return to study? *Please tick the appropriate box.*

	Not applicable	Least applicable	Applicable	Very applicable	Most applicable
To update skills in a specific area					
The topics covered were interesting to me					
As part of professional development					
My manager suggested I attend					
With a view to continuing my studies for a diploma/degree					
To pursue a different career pathway					
Career advancement					
Other (please specify)					

Prior computer experience

14. Have you attended any courses in computer usage outside the School of Nursing?

☐ No (skip to 18)

☐ Yes (please specify the course title)

15. Did this course lead to a formal computer qualification such as the European Computer Driving Licence (ECDL)?

☐ No

☐ Yes (please specify qualification)

16. Why did you attend the course?

☐ My own motivation

☐ My employer made me do it

☐ Other (please specify)

17. What areas did the course cover? *Tick all that apply*

☐ Word processing eg Word

☐ Spreadsheets eg Excel

☐ Databases eg Access, patients record

☐ Presentation eg PowerPoint

☐ Internet use eg Internet Explorer

☐ Email eg Outlook

☐ Other (please specify)

18. Please indicate the level of skill you have with the following computer activities by ticking the appropriate box.

	None	Low	Medium	High
Word processing eg Word				
Spreadsheets eg Excel				
Databases eg Access				
Presentation eg PowerPoint				
Internet use eg Internet Explorer				
Email eg Outlook				
Computer games				
Other (please specify)				

19. Do you think you would be able to do the following? *Tick the appropriate box.*

	Yes	Don't Know	No
Print a document			
Save a document			
Download a document from the Internet			
Bookmark a web page			
Send an email			
Send an email with attachment			

20. Which of the following equipment do you have at home? *Tick all that apply.*

- ☐ Desktop computer or a PC
- ☐ Laptop
- ☐ Mobile phone
- ☐ Personal Digital Assistant
- ☐ IPod or MP3 Player
- ☐ Internet connection such as modem or broadband
- ☐ Printer
- ☐ Scanner
- ☐ Other (please specify)

21. Do you have access to a computer at home?

- ☐ No (skip to 24)
- ☐ Yes

22. Who do you share the home computer with?

- ☐ Nobody
- ☐ Family
- ☐ Friends
- ☐ Other (please specify)

23. What do you use the computer for at home? *Tick all that apply.*

- ☐ I don't
- ☐ Communicating, eg use of email, MSN
- ☐ Accessing the Internet, eg for shopping, banking, looking things up
- ☐ Entertainment
- ☐ Word processing and publishing
- ☐ Record keeping
- ☐ Other (Please specify)

24. Do you have access to the Internet at home?

- ☐ No (skip to 27)
- ☐ Yes

25. What do you use the Internet for at home? *Tick all that apply.*

- ☐ None
- ☐ Email
- ☐ Searching for information
- ☐ Studying
- ☐ Games
- ☐ Banking
- ☐ Shopping
- ☐ Other (Please specify)

26. How often do you access the Internet at home? *Tick the appropriate box.*

- ☐ Never
- ☐ Everyday
- ☐ Every other day
- ☐ At least once a week
- ☐ Other (Please specify) _____

27. Do you have access to a computer at work?

- ☐ No (skip to 31)
- ☐ Yes

28. Who do you share the work computer with?

- ☐ Nobody
- ☐ Colleagues
- ☐ Other (please specify) _____

29. How often do you use the computer at work? *Tick the appropriate box.*

- ☐ Never
- ☐ Everyday
- ☐ Every other day
- ☐ At least once a week
- ☐ Other (Please specify) _____

30. What do you use the computer for at work? *Tick all that apply.*

- ☐ I don't
- ☐ Communicating, eg use of email, MSN
- ☐ Accessing the Internet, eg for shopping, banking, looking things up
- ☐ Entertainment
- ☐ Word processing and publishing
- ☐ Record keeping
- ☐ Other (Please specify) _____

31. Do you have access to the Internet at work?

- ☐ No (skip to 37)
- ☐ Yes

32. What do you use the Internet for at work? *Tick all that apply.*

- ☐ I don't
- ☐ Email
- ☐ Searching for information
- ☐ Studying
- ☐ Shopping
- ☐ Banking
- ☐ Games
- ☐ Other (Please specify) _____

33. How often do you use the Internet at work? *Tick the appropriate box.*

- ☐ Never
- ☐ Everyday
- ☐ Every other day
- ☐ At least once a week
- ☐ Other (Please specify) _____

34. Where do you use the computer most? *Tick the appropriate boxes.*

- ☐ Never
- ☐ Work
- ☐ Home
- ☐ Work and home (equal)
- ☐ Place of study
- ☐ Other (Please specify) _____

35. For how many years have you used the computer? *Tick the appropriate box.*

- ☐ Never
- ☐ Less than 1 year
- ☐ 1 to 3 years
- ☐ 4 to 5 years
- ☐ 6 to 10 years
- ☐ More than 10 years

36. Where do you access the Internet most? *Tick the appropriate boxes.*

- ☐ Never
- ☐ Work
- ☐ Home
- ☐ Work and home (equal)
- ☐ Place of study
- ☐ Other (Please specify) _____

37. For how many years have you used the Internet? *Tick the appropriate box.*

- ☐ Never
- ☐ Less than 1 year
- ☐ 1 to 3 years
- ☐ 4 to 5 years
- ☐ 6 to 10 years
- ☐ More than 10 years

Attitudes to computers in general

Tick the appropriate box.

		Strongly Disagree	Disagree	Neither Agree Nor Disagree	Agree	Strongly Agree
38.	Learning to use computers is essential for nurses working in today's health service					
39.	I feel intimidated if a conversation turns to computers					
40.	I find computers boring					
41.	I believe I could do advanced computer work					
42.	I feel fairly confident when working with computers					
43.	Having computer skills would not enhance my career prospects					
44.	I am not the type to do well with computers					
45.	I do not understand how people can enjoy working with computers					
46.	All nurses should learn something about the computer as part of their course					
47.	I would generally feel OK trying something new on the computer					
48.	I would like a job that involved working with computers					
49.	I expect to use computers in nursing practice					
50.	I am generally quite good with computers					
51.	Figuring out computer problems appeals to me					
52.	I avoid using computers whenever I can					
53.	Having a home computer is a high priority for me					
54.	It would be less important to me to do well in a computer class than in other classes					
55.	I feel threatened by the thought of having to use a computer					
56.	I would like to know more about computers					
57.	I'm often unsure what to do when using a computer					

Attitudes to Web-Based Learning

58. Did you know that the Learning Beyond Registration modules had Web-based learning components before you registered on your current module?

☐ No (skip to 60)

☐ Yes

59. If yes, when did you know?

60. What does Web-based learning mean to you? *Tick all that apply.*

☐ Use of email to communicate with tutors and peers

☐ Use of web discussion forum or chat room to communicate with tutors and peers

☐ Accessing course information, such as module handbooks and timetables

☐ Accessing learning materials, such as lecture notes, Reusable Learning Objects

☐ Online assessment, such as quizzes

☐ Accessing online journals, such as CINAHL

☐ Other (please specify)

61. Out of these potential Web-based learning examples, which do you consider important?

	Not important	Least important	Important	Very important	Most important
Use of email					
Use of web discussion forum or chat room					
Accessing course information					
Accessing learning materials					
Online assessment					
Accessing online journals					
Other (please specify)					

62. How do you feel about using the Internet for learning? *Tick on the appropriate line on the scale.*

Bored	___	___	___	___	___	___	___	**Interested**
Anxious	___	___	___	___	___	___	___	**Calm**
Happy	___	___	___	___	___	___	___	**Sad**
Encouraged	___	___	___	___	___	___	___	**Frustrated**
Isolated	___	___	___	___	___	___	___	**Connected**
Cheated	___	___	___	___	___	___	___	**Supported**
Content	___	___	___	___	___	___	___	**Angry**

63. Do you think you have the computer and Internet skills needed to access your current module on the Web?

☐ No

☐ Yes

64. If not, what computer and Internet training do you think you would need?

65. Do you think the University of Nottingham School of Nursing could have prepared you more for your current module with respect to computer and Internet training?

☐ No

☐ Yes

66. If yes, what computer and Internet training could the School have delivered? *Please put in ranking order of 1 to 7 where 1 is 'most important' and 7 is 'least important'.*

1	
2	
3	
4	
5	
6	
7	

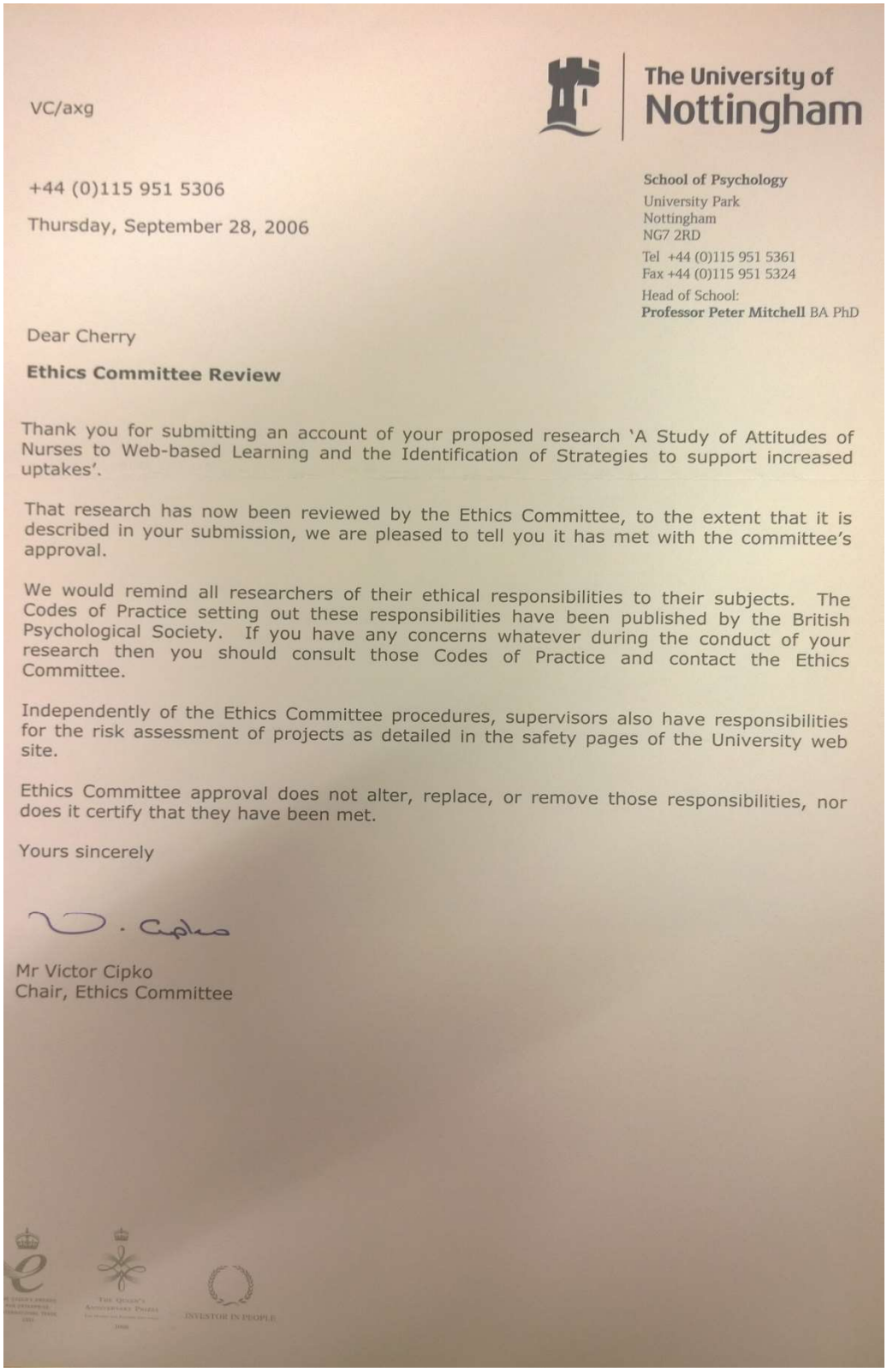
67. How do you prefer the computer and Internet training to be delivered? *Tick the appropriate box.*

- ☐ Web-based (learning on my own)
- ☐ Hands-on teaching session (face-to-face)
- ☐ Paper-based (working through the material on my own)
- ☐ A mixture of web-based, hands-on teaching session and paper-based instruction
- ☐ Other (please specify)

68. Why do you prefer the answer you gave in 67?

Thank you very much for your time.

Appendix 2: Ethics approval – preliminary survey



VC/axg

The University of Nottingham

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School of Psychology
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Tel +44 (0)115 951 5361
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Head of School:
Professor Peter Mitchell BA PhD

Thursday, September 28, 2006

Dear Cherry

Ethics Committee Review

Thank you for submitting an account of your proposed research 'A Study of Attitudes of Nurses to Web-based Learning and the Identification of Strategies to support increased uptakes'.

That research has now been reviewed by the Ethics Committee, to the extent that it is described in your submission, we are pleased to tell you it has met with the committee's approval.

We would remind all researchers of their ethical responsibilities to their subjects. The Codes of Practice setting out these responsibilities have been published by the British Psychological Society. If you have any concerns whatever during the conduct of your research then you should consult those Codes of Practice and contact the Ethics Committee.

Independently of the Ethics Committee procedures, supervisors also have responsibilities for the risk assessment of projects as detailed in the safety pages of the University web site.

Ethics Committee approval does not alter, replace, or remove those responsibilities, nor does it certify that they have been met.

Yours sincerely

Mr Victor Cipko
Chair, Ethics Committee

Appendix 3: Ethics approval – experimental design

VC/axg



The University of Nottingham

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School of Psychology
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Fax +44 (0)115 951 5324
Head of School:
Professor Peter Mitchell BA PhD

Monday, March 31, 2008

Dear Cherry Pousa

Ethics Committee Review

Thank you for submitting your research 'Intervening for self-efficacy in preparing nursing for Web-based learning'.

That research has now been reviewed, to the extent that it is described in your submission, we are pleased to tell you it has met with the chair's approval.

We would remind all researchers of their ethical responsibilities to their subjects. The Codes of Practice setting out these responsibilities have been published by the British Psychological Society. If you have any concerns whatever during the conduct of your research then you should consult those Codes of Practice and contact the Ethics Committee.

Independently of the Ethics Committee procedures, supervisors also have responsibilities for the risk assessment of projects as detailed in the safety pages of the University web site.

Ethics Committee approval does not alter, replace, or remove those responsibilities, nor does it certify that they have been met.

Yours sincerely

Mr Victor Cipko
Chair, Ethics Committee

Appendix 4: Information Sheet for Control Group

Survey of Post-Registration Nursing Students' Web-Based Learning Self-Efficacy

Information to Participants

You are invited to take part in a questionnaire survey exploring nurses' Web-based learning self-efficacy. The aim of the study is to gain an understanding on nurses' beliefs in their capability in using the Web for learning in order that the University of Nottingham School of Nursing can prepare them better prior to starting a Web-based course.

Participation in this study is totally voluntary, and you are under no obligation to take part in this study. You are free to withdraw at any point prior to returning the questionnaire (you may destroy the questionnaire of you wish). All data collected will be kept confidential and used for research purposes only. The consent forms will be kept separate from the questionnaires. Please briefly examine the questionnaire before signing this consent form.

There are no trick questions in this survey. There are no right or wrong answers. Your name or any identifying characteristics will not be available to anyone, other than my supervisor and me, at any point.

If you have any questions you may contact me.

Cherry Poussa
PhD Student (Learning Sciences Research Institute)/
Web and Media Manager (School of Nursing)
A Floor, Medical School
Queen's Medical Centre
Nottingham NG7 2UH
Tel: 0115 82 30795
Email: cherry.poussa@nottingham.ac.uk

Supervisors:

Dr Shaaron Ainsworth, School of Psychology/Learning Sciences Research Institute
Dr Heather Wharrad, School of Nursing

Appendix 5: Information Sheet for Intervention Groups

Post-Registration Nursing Students' Web-Based Learning pre-course training

Information to Participants

You are invited to take part in a pre-course training designed to prepare nurses for Web-based learning. The aim of the study is to determine if a pre-course training on Web-based learning is beneficial in preparing nurses for a course that is Web-based or has online components in order that the University of Nottingham School of Nursing can prepare them better prior to starting a Web-based course.

Participation in this study is totally voluntary, and you are under no obligation to take part in this study. You are free to withdraw at any point prior to undertaking the pre-course training. Three surveys will be distributed before and after the training session and again after the course to measure the effectiveness of the training package. All data collected will be kept confidential and used for research purposes only. The consent forms will be kept separate from the surveys. Please briefly examine the surveys before signing this consent form.

There are no trick questions in the surveys. There are no right or wrong answers. Your name or any identifying characteristics will not be available to anyone, other than my supervisors and me, at any point.

If you have any questions you may contact me.

Cherry Poussa
PhD Student (Learning Sciences Research Institute)/
Web and Media Manager (School of Nursing)
A Floor, Medical School
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Supervisors:

Dr Shaaron Ainsworth, School of Psychology/Learning Sciences Research Institute
Dr Heather Wharrad, School of Nursing

Appendix 6: Consent Form for control group

Consent Form

Project Title:
Survey of Post-Registration Nursing Students' Web-Based Learning Self-Efficacy

Investigators:
Cherry Poussa, PhD Student, Learning Sciences Research Institute (LSRI)
Shaaron Ainsworth, School of Psychology
Heather Wharrad, School of Nursing, University of Nottingham

If you have any queries about the survey, please ask Cherry before signing this Consent Form.

You should complete the whole of this sheet yourself. Please tick all of the following boxes.

I have read and understood the participant information sheet	☐
I have had the opportunity to ask questions about the survey and any questions I have had have been answered	☐
I have received enough information about the survey	☐
I understand that I am free to withdraw from the survey at any time and without having to give a reason	☐

"This survey has been explained to me to my satisfaction, and I agree to take part."

Signature of the Participant:	Date:

Researcher's Name: Cherry Poussa

Signature of the Researcher:	Date:

Appendix 7: Consent Form for intervention groups

Consent Form

Project Title:
Post-Registration Nursing Students' Web-Based Learning pre-course training

Investigators:
Cherry Poussa, PhD Student, Learning Sciences Research Institute (LSRI)
Shaaron Ainsworth, School of Psychology
Heather Wharrad, School of Nursing, University of Nottingham

If you have any queries about the training, please ask Cherry before signing this Consent Form.

You should complete the whole of this sheet yourself. Please tick all of the following boxes.

I have read and understood the participant information sheet	☐
I have had the opportunity to ask questions about the training and any questions I have had have been answered	☐
I have received enough information about the training	☐
I understand that I am free to withdraw from the training at any time and without having to give a reason	☐

"This training has been explained to me to my satisfaction, and I agree to take part."

Signature of the Participant:	Date:

Researcher's Name: Cherry Poussa

Signature of the Researcher:	Date:

Appendix 8: Web-based Learning Knowledge and Skills test

1. Do you agree with this statement: "On a Web page, you can always tell what links look like because the words are always underlined in blue".

*Circle **one** answer from the following.*

a. No, links are not underlined in blue.

b. No, links are underlined in red.

c. No, it's only typical that links are underlined in blue.

d. Yes, links are always underlined in blue.

2. Which of the following is NOT a type of web link?

*Circle **one** answer from the following.*

a. Links on the website that you're currently on, pointing to pages within the same site.

b. Links on the website that you're currently on, pointing to a document on your computer.

c. Links on the website that you're currently on, pointing to pages on somebody else's site.

d. Links on the web page that you're currently on, pointing to sections on the same page.

3. When somebody says that a link is 'dead' or 'broken', what do they mean?

*Circle **one** answer from the following.*

a. When you get lots of windows popping up that you don't expect.

b. When a link doesn't open a new window.

c. When you don't manage to log on to a restricted website.

d. When a link doesn't take you to another page as expected.

4. What is the quickest way to recover from a dead link?

*Circle **one** answer from the following.*

a. By closing the browser and starting over.

b. By clicking the Back button or closing the new window.

c. By clicking the Forward button.

d. By going back to the website home page and starting over.

5. How can you tell that you have followed or visited a text link?

*Circle **one** answer from the following.*

a. The colour of the link typically turns from red to green.
b. The colour of the link typically turns from blue to purple.
c. The link disappears after you've clicked on it once.
d. It is impossible to tell.

6. How do you search for pages that only contain the exact phrase you type in?

*Circle **one** answer from the following.*

a. By putting a "+" sign in front of the phrase.
b. By placing the tilde sign (~) immediately in front of your search term.
c. By "surrounding your phrase with quotes."
d. By putting a "-" sign in front of the phrase.

7. How do you search for pages that only contain **the word virus but NOT the word computer**?

*Circle **one** answer from the following.*

a. By putting a "-" sign in front of the word **computer** as part of the search term.
b. By putting a "+" sign in front of the word **virus** as part of the search term.
c. By surrounding **computer virus** with quotes.
d. By placing the tilde sign (~) immediately in front of the word **virus**.

8. If you 'bookmark' a page on a website, this means that you:

*Circle **one** answer from the following.*

a. Save the entire website on your computer so you can view it later without connecting to the Internet.
b. Save the web address of the website that you're looking at on your local machine.
c. Copy the web address and paste it in another document on your computer.
d. Copy the web address and email it to yourself.

9. How best do you retrieve a website that you have bookmarked on your browser?

*Circle **one** answer from the following.*

a. By opening the saved web address from the Favourites or Bookmarks.
b. By typing the web address in the address box on your browser.
c. By searching for the website on a search engine such as Google.
d. By checking the history of visited websites on your browser.

10. When you 'download' a document from a website, this means that you save a copy of the document on your local computer. How do you know where it goes?

*Circle **one** answer from the following.*

a. By opening a program such as Word and navigate the folders on my computer until I find the document.
b. By searching for it using the search function on my computer.
c. By opening the different folders on my computer and find the downloaded document.
d. By saving the document on a dedicated downloads folder.

11. What is an online discussion forum?

*Circle **one** answer from the following.*

a. An area which allows you to read your email online.
b. An area within a website where you can read and reply to messages posted by other people.
c. An area within a website where you can have a real-time conversation with other people.
d. An area within a website where you can leave feedback for example about things you bought online.

12. What is a virtual learning environment?

*Circle **one** answer from the following.*

a. A system that works over the Internet designed to support student registration.
b. A system that works over the Internet where you can search for online books and journal articles.
c. A system that works over the Internet containing learning resources.
d. A system that works over the Internet to manage emails from students.

End of questions

Appendix 9: Web-based Learning Self-Efficacy Measure

Often on some modules we are told about websites that contain resources or activities for the modules. For the following questions, imagine that you were asked to use a new website for some aspect of the module. It doesn't matter specifically what this website does, only that it is intended to complement your module and that you have never used it before.

The following questions ask you to indicate whether you could use this unfamiliar website under a variety of conditions. For each of the conditions, please circle No or Yes whether you think you would be able to do the module using the website.

I could do the module and use the websites associated with it ...			**If Yes, please rate your confidence.** not at all confident totally confident									
...if there was no one around to tell me what to do as I go	**No**	**Yes**	1	2	3	4	*5*	6	7	8	9	10
… if I had never used a website like it before.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if I had only the instructions to use it for reference	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if I had seen someone else using it before trying it myself	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if I could call someone for help if I got stuck.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if someone else had helped me get started.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if I had a lot of time to complete the module for which the website was provided.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if I had just the built-in help facility for assistance.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
...if someone showed me how to do it first.	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10
... if I had used similar websites before this one to do the module	**No**	**Yes**	1	2	3	4	5	6	7	8	9	10