The Effectiveness of Web-enhanced Self-directed Learning in Promoting Information Literacy of Nursing Students in Taiwan

by

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Abstract

**Background and Purpose:** It has become imperative for health professionals to have information literacy, including database searching skills, to enable them to practise contemporary quality patient care, and developing information literacy requires computer literacy and self-directed learning (SDL). More than the half of the current nursing workforce in Taiwan graduate from an Associate Degree in Nursing (ADN) program, but the effectiveness of integrating e-learning to promote the information literacy and SDL of students in the ADN program is unclear. This study investigated whether a researcher-developed web-enhanced education intervention guided by Knowles’ Adult Learning Theory (KALT) would improve Taiwanese ADN students’ online searching knowledge, skills, self-efficacy, and self-directed learning. The 10-week intervention comprised a self-paced online learning package, an online forum, a face-to-face tutorial, and an optional weekly drop-in session.

**Method:** A mixed methods intervention design was used with focus groups, following pre and post-test questionnaires. A total of 142 ADN students were recruited and allocated to the experimental group ($n = 69$), or the control group which simply received face-to-face instruction ($n = 73$) using cluster randomisation. The learning outcomes were measured using an online searching knowledge test (OSKT) and online searching skills test (OSST) developed by the researcher, the Online Searching Skills Self-efficacy Inventory (OSSI), and the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE). The level of significance was set with an $\alpha$ of .05. Four semi-structured questions were used to guide the focus group discussions in Chinese. Comments made in the focus groups were recorded and fully transcribed, then analysed using free-form coding with translation into English. Participants’ responses were thematically analysed guided by the five research questions. Triangulation was achieved with the convergence of findings from the two separate data sources.

**Results and Implications:** At baseline there was no statistically significant difference between the experimental and control groups regarding their demographic,
background, or the outcome variables (their OSKT, OSST, OSSI, and SDLRSNE scores). After the intervention, the OSSI scores of the experimental group were statistically significantly higher than those in the control group (t = 2.19, p = .027). Focus group data supported the quantitative results and clearly indicated that the experimental group participants benefited from the self-paced additional online learning materials in combination with timely feedback via the online forum. The web-enhanced approach offered learning support that closely matched participants’ learning needs, although there was no statistically significant difference between the OSKT, OSST, and SDL scores of the control group and the experimental group. Control group participants reported feeling information overload. They remarked on the lack of hands-on exercise during their short face-to-face instruction session, and commented negatively on group discussion when teachers were not present, and on previous e-learning experiences involving limited teacher-student interaction. In contrast, the experimental group participants reported that the intervention supported development of their online searching skills and promoted learning engagement and time management skills.

This study provides empirical evidence of the usefulness of KALT for guiding the use of online teaching strategies to develop the information literacy of Taiwanese nursing students. The findings support Knowles’ assumptions that adults prefer problem-solving and life-related learning based on their previous experience. The researcher recommends that information literacy education be started at the earliest stage of the ADN program in order to better prepare students for evidence-based practice. Ongoing facilitation by teaching staff should assist ADN students engaging in experiential learning in the area of information literacy to enhance students’ positive learning experiences and outcomes, particularly when project-based group assignments are used.

**Conclusion:** This study indicates that a web-enhanced learner-focused approach, informed by KALT, can support students’ online searching self-efficacy. An online forum with timely feedback from lecturers is more likely to encourage students’ SDL and learning satisfaction, and to closely match their learning needs. As a result, group assignments can be adopted by more courses for developing ADN students’ required knowledge, skills, and attitudes. It is recommended that teaching strategies informed
by KALT be used in more courses within ADN programs to develop the students’ information literacy and SDL, and thereby help adequately prepare them for evidence-based nursing practice.

**Keywords:** learning methods; computer-assisted instruction; self-directed learning; nursing education; information literacy.
Statement of originality

This work has not previously been submitted for a degree or diploma in any university. To the best of my knowledge and belief, the thesis contains no materials previously published or written by another person except where due reference is made in the thesis itself.

Tsai Ling-Chun
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Glossary

1. **E-learning**: The term “electronic learning” (e-learning) refers to a range of learning experiences that usually use computers and technology to support learning and teaching (Donnelly, Benson, & Kirk., 2012).

2. **Web-enhanced approach**: This approach is a hybrid learning approach that combines campus-based face-to-face instruction with some online learning activities using a web-based platform (Billings, 2000; Salyers, 2005; Schmidt, 2002).

3. **Information literacy**: “Information literacy” is defined by the American Library Association (2000) as “a set of abilities requiring individuals to recognize when information is needed and [to] have the ability to locate, evaluate, and use effectively the needed information”.

4. **Information searching literacy**: The knowledge and skills that individuals demonstrate while locating information.

5. **Online searching knowledge**: The knowledge of individuals in locating information using electronic resources. In this thesis, this term specifically refers to the use of library databases.

6. **Online searching skills**: The skills individuals employ while locating information using library databases.

7. **Online searching self-efficacy**: This concept is measured using the Online Searching Self-efficacy Inventory developed by Monoi, O'Hanlon, and Diaz (2005).

8. **Self-directed learning**: This concept is measured using the Self-Directed
9. **Associate Degree in Nursing students:** Students who graduate from this five-year program in Taiwan will earn an Associate Degree in Nursing. The majority of the Associate Degree in Nursing students in Taiwan are female and their ages range between 16 and 20 years.

10. **Experimental group:** The group of students who received a web-enhanced education intervention with the aim of improving their online searching knowledge, skills, self-efficacy, and self-directed learning readiness.

11. **Control group:** One group of Associate Degree in Nursing students who did not receive a web-enhanced education intervention. In this current study, the control group serves as a comparison with the group of students who received the education intervention.

12. **Intervention:** A web-enhanced instruction that aims to improve the participants’ online searching knowledge, skills, self-efficacy, and self-directed learning readiness. This intervention comprises a self-paced online tutorial, an online forum, a face-to-face tutorial with the researcher, and a drop-in session per week as requested.

Learning Readiness Scale for Nursing Education developed by Fisher, King, and Tague (2001).
# List of abbreviations

<table>
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<td>1. ADN</td>
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Dissemination of study results

Conference presentations


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Chapter 1: Introduction

We live in an era of exponential knowledge proliferation and technological change. Technology-enhanced education has, in the past two decades, become increasingly significant in nursing education with attention being focused on how electronic learning (e-learning) supports improvements in self-directed learning (SDL). An important focus for nurse education research is the use of technology-enhanced education for students of nursing, and the effectiveness, or otherwise, of integrating e-learning into the teaching of information literacy. This study adds to the existing body of knowledge by examining the effectiveness of a web-enhanced education in the teaching of online searching skills for accessing Chinese language databases by students in Associate Degree in Nursing (ADN) programs in Taiwan. The thesis identifies the effectiveness of a web-enhanced approach in improving Taiwanese nursing students’ self-directed learning.

This chapter outlines the increasing significance of technology-enhanced education in the nursing discipline, the association of self-directed learning in the nursing discipline, and the case for integrating e-learning into teaching online searching skills. The nature of ADN programs in Taiwan and their students is presented. This chapter also introduces the theory that informs the design of the educational intervention tested, articulates the study aims and objectives, poses the research questions, and outlines the overall structure of the thesis.

1.1 Background

This section briefly outlines the uptake of technology-enhanced courses and SDL in education, in particular within the discipline of nursing. In addition, the significance of information literacy education for the nursing profession is highlighted. Taiwan’s ADN are discussed in detail, and the applicability of Knowles’ (1990) Adult Learning Theory and Problem-Based Learning in nursing education are discussed.
1.1.1 The integration of e-learning into higher education

The development of information communication technology contributes to the adoption of e-learning in the higher education sector in many countries and in many disciplines (Kukulsk-Hulme, 2012; Lai, 2011; Samarawickrema & Stacey, 2007). This ‘high-tech’ approach not only increases students’ access to higher education institutions (Gabbert & Sims, 2007) but also provides them with flexible and self-paced learning (Schneiderman, Corbridge, & Zerwic, 2009). In addition, students are encouraged to take a more active role in the learning process through the use of online self-directed learning experiences (Thompson, Ford, & Webster, 2011) that foster lifelong learning (Lai, 2011). Therefore, many institutions have turned to technology as a resource to enrich the curriculum and to provide students with learning experiences and opportunities beyond the traditional university classroom (Comrie, 2011; Kukulsk-Hulme, 2012; Lai, 2011). The advantages of e-learning also bring attention to the nursing discipline; particularly in the area of improving self-directed learning (Billings, Skiba, & Connors, 2005; Gabbert & Sims, 2007; Giddens, 2007).

The term electronic learning (e-learning) refers to a range of learning experiences which usually use computers and technology to support learning and teaching (Donnelly et al., 2012). A variety of related terms have been used to describe the application of the e-element as a set of tools to facilitate the learning process, including web-based training/instruction (WBT/I), computer-based training (CBT), computer-aided (assisted) learning/instruction (CAL/I) and technology-enhanced learning (TEL). The e-element can be online or not, such as using CD-ROM, or audio or video tape to facilitate self-paced instructor-led learning. However, the term is most likely to be used to describe learning experiences out-of-classroom and in-classroom with support of or delivered by technology (Parsons & Griffiths, 2007; Tait, Tait, Thornton, & Edwards, 2008).

According to the degree of computer-based learning activities involved, e-learning can be divided into web-based learning and web-enhanced learning. Social isolation is one significant disadvantage limitation of a fully web-based learning program (Holley & Taylor, 2009). To combat this disadvantage, web-enhanced learning offers a hybrid
learning approach that combines campus-based face-to-face instruction with some online learning activities (Billings, 2000; Salyers, 2005; Schmidt, 2002). This approach means web presence, where static, paper-based materials, such as course syllabi, are placed on a course website. Moreover, it can be interactive through the use of synchronous or asynchronous online discussion boards on a course website (Hayward, 2004). This hybrid approach provides alternative learning experiences to support students with different learning style preferences and avoids the disadvantage of isolating students undertaking a wholly web-based course (Thorne, 2003).

In Taiwan, four e-courses were first introduced in 2001 across three universities (Wu, 2004). By 2006, more than 60 higher education institutions in Taiwan had adopted e-learning, and the number of courses into which an e-element had been integrated had increased to more than 1,700 courses with a total enrolment of approximately 120,000 students (Lu Chun-Yi 劉君毅, 2007). Currently, many universities in Taiwan have integrated e-learning into campus-based curricula, as a web-enhanced approach can expand students’ learning experiences and avoid the main disadvantage associated with online learning previously mentioned (Thorne, 2003). Regulations issued by the Taiwanese Ministry of Education in 2005 directed all university e-learning courses to include both face-to-face on-campus instruction and online learning activities (Taiwan Ministry of Education 教育部, 2013).

Several factors are promoting the widespread uptake of e-learning within the nursing discipline internationally. In the United Kingdom (UK), the aim is to widen the range of students’ learning experiences (Tait et al., 2008); in Taiwan and Korea, the aim is to enhance learning effectiveness and mastery of material (Chen Shu-Wen 陳淑雯, Chiu Shu-Ching 邱淑卿, Shah Dah-Ming 夏大明, & Chung Yueh-Chin 鍾月琴,

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1 台灣大學開設網路企業班 (Taiwan University: e-business course); 清華大學開設大陸科技法律班 (Tsinghua University: Law of Science and Technology in Mainland Chinese); 中山大學開設 e-manager 企業經理人線上碩士學分班和系統管理工程師 MCSE 認證學分班 (Sun Yat-sen University: the e-manager, a Master online credit course and the Systems Management Engineer MCSE certification credit course).

2 In text citation appears both Chinese characters and English when the cited reference has been published in Chinese.

3 大學遠距教學實施辦法頒布於2005年8月5日(Regulations for the implementation of e-learning at universities issued on 5th August 2005).
2005; Jang, Kim, & Park, 2006); and in the United States of America (USA), the aim is to increase student satisfaction and enjoyment in learning (Buckley, 2003; Mitchell, Ryan, Carson, & McCann, 2007; Salyers, 2005, 2007). Incorporating e-learning can help universities to maintain consistent educational delivery; it can reduce instruction time and costs, particularly those associated with basic subjects taught year after year with the content remaining relatively unchanged (Peterson, 2006; Sung, Kwon, & Ryu, 2008); and it has been shown to improve retention rates of nursing students in both the USA and in Taiwan (Billings, 2007; Yu, Chen, Yang, Wang, & Yen, 2007). Retention rate data in these countries is in part explained by the high enrolment of mature and part-time students (Billings, 2007; Yu et al., 2007).

At the same time, the e-learning approach is appropriate for traditional school leavers as they have been categorised as digital natives who are surrounded by and immersed in technologies in their daily life (Comrie, 2011; Lai, 2011). The term, Generation Y, also known as the Millennials, refers to those individuals born between 1977 and 1998 (approximately 70 million people); these people are described as ‘technology savvy’ and their skill base has contributed to the shift in teaching paradigms from traditional teacher-led classroom teaching to technology-enhanced learner-centred education, which better accommodates these digital natives (Billings, 2004; Skiba & Barton, 2006).

Many nursing courses in Taiwan have an integrated e-learning element to augment learning by undergraduate students (Chen, Stocker, Wang, Chung, & Chen, 2009; Huang et al., 2007; Tung & Chang, 2008) and by nurses (Liang & Wu, 2010; Yu & Yang, 2006). Importantly, however, research from the USA and Taiwan reports inconclusive results relating to the effectiveness of web-enhanced approaches in nursing students’ learning (Buckley, 2003; Chen Shu-Wen 陳淑雯 et al., 2005; Salyers, 2005, 2007). Thus, a further study that focuses on e-learning effectiveness in student learning is imperative considering the importance and assumptions underpinning its use.

Based on a literature review in the UK, Clark (2005) commented that the effectiveness and satisfaction offered by online learning is affected more by the
adaption of learning theories and instructional strategies incorporated into the learning materials than by the type of technology used to deliver the instruction. This statement has been supported by other scholars (Arabasz & Baker, 2003; Chickering & Ehrmann, 1996). There is an absence of research articulating and examining the theory underpinning e-learning in nursing education (Kala, Isaramalai, & Poththong, 2010). Academics and nurse educators developing online activities are encouraged to draw on educational theories and principles that have been demonstrated to promote the quality of student learning (Barker, 2003). Knowledge gaps associated with the absence of research articulating and examining the theory underpinning how to incorporate e-learning in nursing education (Kala et al., 2010) need to be addressed.

1.1.2 Self-directed learning

Self-directed learning (SDL) is associated with professional autonomy and, as a mode of learning in nursing education, aims to ensure that nurses develop independent learning skills and a sense of accountability, both of which are essential to assist them to function fully as professionals in a constantly changing work environment (Levett-Jones, 2005). We live in an era of exponential knowledge proliferation and technological change (Williams, 2001). In order to maximize the benefits of continuous learning to enhance professional functionality, clinical nurses need to be able to engage in SDL, and it is essential for training institutions to incorporate content and delivery that helps students to master a repertoire of associated knowledge and skills (Patterson, Crooks, & Lunyk-Child, 2002; Williams, 2001).

SDL is a universal disposition of adult learners, who are assumed to exhibit an increased tendency to be independent (Brookfield, 2009). Knowles, Holton, and Swanson (2005) highlight that adults’ SDL could be influenced by goals and purposes for learning and individual and situational differences, including learning style, previous experience with the subject matter, social orientation, and previous learning socialisation. Therefore, the successful introduction of SDL into the curriculum requires significant changes for both the teacher and student, who may be used to more formal didactic classes. This supports the argument for a balance between teacher-directed and student-directed learning (Levett-Jones, 2005; Timmins, 2008).
Grow (1991) highlighted the role of teachers in the facilitation of SDL is to match learning styles with the students; otherwise, problems can arise when there is a disparity, a lack of a “workable match”, between the teaching styles of teachers and the learning stages of learners\(^4\). In order to prepare students’ SDL, two useful strategies are recommended: explaining the purpose and methods of SDL (Knowles et al., 2005; Levett-Jones, 2005; Saha, 2006), and creating a learner-centred atmosphere (Boyer, 2003; Jones, 1994; Kicken, Brand-Gruwel, Merrieenboer, & Slot, 2009).

In order to create a learner-centred atmosphere, nursing education has embraced e-learning (Chen et al., 2009; Hong, Lai, & Holton, 2003; Matuga, 2001; Mitchell et al., 2007; Salyers, 2005; Thiele, 2003), PBL (Kocaman, Dicle, & Ugur, 2009; Malta, Dimeo, & Carey, 2010; Saha, 2006; Shankar et al., 2011; Yuan, Williams, Fang, & Pang, 2012) and the use of learning portfolios and contracts to assist students in becoming reflective and self-directed learners (Boyer, 2003; Kicken et al., 2009). The embracing of and support for e-learning and associated initiatives are particularly prevalent in Taiwan (Taiwan Ministry of Education 教育部, 2013) and support the focus of this study in this context.

### 1.1.3 Information literacy

Information literacy, accordingly to the most widely-known definition offered by the American Library Association (2000), is the ability of an individual to recognise relevant information, and to have the ability to locate, evaluate, and to effectively use the information. This set of skills is increasingly important in the contemporary environment of rapid technological change and proliferating information resources. This set of abilities can help individuals to cope with diverse, abundant information choices in their lives, workplaces, and studies, and to enable them to master content and to extend their investigations. As a result, in the contemporary ‘information age’, information literate individuals can be more self-directed and assumed to have greater control over their own learning (American Library Association, 2000; Lupton, 2004).

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\(^4\)The teacher's goal is to find a “workable match” (Grow, 1991, p. 129) between the students' learning stage and the teacher's teaching style.
It is widely recognized within the health care system that there is an extraordinary proliferation of information in the form of electronic resources due to rapid technological advances (Shanahan, 2007). This has created a pressing need for nursing schools to put in place strategies to help students to develop effective skills to conduct online information searches and to develop their knowledge of and ability to use professional databases (Barnard, Nash, & O’Brien, 2005).

EBP – evidence-based practice – is the gold standard in nursing to support patient safety and effective health care, as it is in medicine, a closely associated field (Penz & Bassendowski, 2006; Shorten, Wallace, & Crookes, 2001). For nurses, EBP means applying valid, appropriate, and research-based information in their decision-making (Cullum, Ciliska, Marks, & Haynes, 2008). It is clear from the definition given above that information literacy is a fundamental, essential element of evidence-based practice (Janke, Pesut, & Erbacker, 2012; Pravikoff, Tanner, & Pierce, 2005; Shorten et al., 2001). The ability to access and assess up-to-date, peer reviewed, empirical research is both a prerequisite to and an ongoing part of EBP (Shorten et al., 2001). Having this ability is essential to a systematic approach to problem solving for health care providers; however, in the USA, nurses were reported to have not sufficient information literacy competency for EBP in clinical settings (Pravikoff et al., 2005).

Some suggest that one of the most imperative educational needs of students preparing to practice evidence-based nursing care is to acquire the knowledge and skills to undertake information searches using academic databases (Chang Chin-Nan 張慶南 et al., 2007; Dee & Stanley, 2005; Hao Chia-Chi郝家琪 & Hsu Li-Ling許麗齡, 2008; Koivunen, Välimäki, & Hätönen, 2010; Yeh Ching-ling葉慶玲, 2000). This includes an understanding of the large range of library databases available, the skills to use them, and the ability to identify research problems and to develop effective search strategies to find relevant information (Burkhardt, 2007; Dorner, Taylor, & Hodson-Carlton, 2001).

The nursing profession in the USA has recognised the importance of teaching information literacy, including information searching using databases, and this has already been integrated into both the bachelor’s and postgraduate nursing curricula.
(Dorner et al., 2001; Flood, Gasiewicz, & Delpier, 2010). In addition, several studies have demonstrated the effectiveness of using a traditional face-to-face approach in improving bachelor’s degree nursing students’ information literacy competency in many countries, including the USA, the UK, Australia, Hong Kong, and Taiwan (Craig & Corrall, 2007; Grant & Brettle, 2006; Ku, Sheu, & Kuo, 2007; Tarrant, Dodgson, & Law, 2008). Nevertheless, there is a substantial lack of information about the teaching of information literacy, in particular for ADN students in Taiwan.

It is argued that although face-to-face instruction has been found to effectively improve the information literacy competency of bachelor’s degree nursing students in many countries, in this digital era a technology-enhanced approach is optimal for supporting information literacy education (Grant & Brettle, 2006; Schutt & Hightower, 2009). Incorporating technology to enhance teaching has been shown to be an effective teaching method (Holman, 2000; Nichols, Shaffer, & Shockey, 2003; Salisbury & Ellis, 2003; Wilhite, 2004; Zhang, Watson, & Banfield, 2007) and allows ‘technology savvy’ students to repeatedly review instructional materials (Dorner et al., 2001). Research has also demonstrated the effectiveness of using a web-based interactive information skills tutorial in improving postgraduate nursing students’ overall search skills (Grant & Brettle, 2006) and increasing the library skills of postgraduate education faculty students in the USA (Beile & Boote, 2004). Little exploration has been conducted, however, into the effectiveness of technology-enhanced education for teaching or improving the information search skills of Taiwan nursing students enrolled in a bachelor’s degree or an associate degree. As mentioned above, graduates from these programs make up 57% of all nurses in Taiwan, so research focusing on the effectiveness of interventions to improve information literacy learning would significantly benefit the development of the nursing discipline and nursing care in Taiwan.

1.1.4 Associate Degree in Nursing students in Taiwan

The beginning of Taiwan’s nursing education was situated in practically focused, hospital-based training courses in the late 1890s. School-based Nursing education programs in Taiwan commenced in the 1940s with, in 1945, the first Nursing
Vocational High School being established. After this time, several developmental stages of nursing education have been recorded, including the start of a Bachelor of Science Nursing (BSN) degree program in 1956, the upgrade of the Nursing Vocational High School to a Nursing Junior College offering a five-year nursing program (with associate degree) in the early 1960s, the introduction of the first PhD program in nursing through the National Taiwan University in 1997, and the termination of the Nursing Vocational High School in 2005 (Yu-Mei Chao (Yu), 2008).

Until 2010, there was a total of 41 schools in Taiwan offering basic nursing education programs leading to either an associate degree or a bachelor’s degree. Fourteen of these schools are under the jurisdiction of the Department of Higher Education (HE) of the Ministry of Education (MOE), and another 27 nursing schools/departments are under the jurisdiction of the Department of Technology and Vocational Education (TVE) of MOE. As shown in Figure 1, schools from the TVE sector offer a variety of nursing programs, including a four-year BSN degree program, a two-year BSN degree program, and a five-year ADN program. On the other hand, nursing schools from the HE system provide mainly BSN programs. Four of them also provide a two-year BSN degree program (Yeh Chang Mei 張媚 & Chao Yu Yu-Mei 余玉媚, 2010).

Graduates of ADN programs in Taiwan practise in clinical settings upon graduation, with about one-third of the graduates choosing to continue their studies through an additional two-year Bachelor’s Degree Program (Lin Chia-Chin 林佳靜 et al., 2008). Despite the different education programs, the role and clinical practice of all new staff nurses are identical regardless of their pathway to graduation. There are two types of primary nurses in Taiwan: Licensed Practical Nurses (LPNs), and Registered Nurses (RNs). Since 2006, another small group of advanced practice nurses, called Nurse Practitioners (NP), was granted a NP certification after passing an examination by a credible institution. According to the Nursing Regulation document in Taiwan issued in May 1991, there is no distinction between LPNs and RNs who are the main nursing workforce in clinical practice. Their roles include conducting patient health assessments, providing health prevention and nursing care, providing patient education, and supporting medical treatments such as medication supervision.
Moreover, graduates from all programs are qualified to acquire registered nurse licences if they pass the National Registered Nurses Examination conducted by Examination Yuan of Taiwan.

Numerous studies in Taiwan have demonstrated that nursing competency is related to nurses education backgrounds (Chang Ying-ying 張瑛瑛 & Wang Man-his 王曼溪, 2008; Tsai Shu-Fang 蔡淑芳, Chung Chao-Ming 莊照明, & Chien Tzu-Chuan 简姿娟, 2009; Wu Tzu-Jung 吳姿蓉, Teng Ching-Hwa 鄧慶華, Chih Mei-Hau 池美華, Tseng Shu-Mei 曾淑梅, & YuanSu-Chuan 袁素娟, 2007; Yu S 于淑 & Ma F-C 馬鳳歧, 1993). Historically, the ability of nursing students in terms of information literacy and research is less emphasised throughout the training process in the TVE system compared to the HE system (Hao Chia-Chi 郝家琪 & Hsu Li-Ling 許麗玲, 2008; Lee Sheuan 李選, Lu Ying-Chi 盧瑛琪, Yen Wen-Jiuan 顏文娟, & Lin Shu-Chin 林淑琴, 2004; Lin Yi-Jung 林宜蓉, Tu Yu-Ching 杜玉卿, & Hsieh Hsu-Ling 謝旭玲, 2009).

The number of graduates from a five-year ADN program is the greatest portion (about 70%) amongst all the nursing students in Taiwan, including junior college and undergraduate students (Yeh Chang Mei 張媚 & Chao Yu Yu-Mei 余玉眉, 2010).

Hence, graduates from the ADN program represent more than half of the clinical nursing workforce in Taiwan (Mei Chang & Yu-Mei Chao (Yu), 2008). Information literacy education for this large proportion of nurses who graduate from the ADN program in the TVE system is not emphasised and therefore inferior to those nursing students who graduate through the HE system. This represents a significant issue for nursing education in Taiwan today as the vast majority of clinical nurses graduate from the ADN program. This situation clearly supports the need to examine nurse education interventions that can address the assumed deficit in information literacy learning and its clinical implications in this important group of student nurses.
1.1.5 Knowles’ Adult Learning Theory and Problem-Based Learning

This study draws on Knowles’ Adult Learning Theory (KALT). This andragogical model assumed adult learners to be self-directed, experienced, and intrinsically motivated to learn life-related and problem-solving information (Knowles, 1990). KALT is useful in the nursing discipline (Clapper, 2010). The assumptions of Knowles (please, see Chapter 3 on page 55) articulate that learning is a transformation of learners’ previous experience, and that their learning will be optimised when
learning meets their real life needs such as problem solved. Thus, KALT has been
applied to inform interventions in a variety of nursing education, including formal
school education (Bowers, 2004; Feingold, Calaluce, & Kallen, 2004; Frazer, 2007;
Gabbert, 2007; Olson, Stedman-Smith, & Fredrickson, 2005; Shepard, 2009);
continuing professional development (Hopstock, 2008; Mayer, Andrusyszyn, &
Iwasiw, 2005; Wright, 2008); and patient education (Heck, 2008; Mitchell &
Courtney, 2005). In addition, the principles are valuable in guiding teaching using
traditional face-to-face instruction (Blozen, 2011; Bowers, 2004; Feingold et al., 2004;
Frazer, 2007; Heck, 2008; Hopstock, 2008; Mayer et al., 2005; Mitchell & Courtney,
2005; Molsbee, 2011; Norrie & Dalby, 2007; Shepard, 2009; Wright, 2008), as well
as an e-learning approach (Gabbert, 2007; Olson et al., 2005).

The applicability of KALT is founded on the premise that the aim of the educational
intervention is to develop the self-directed learning ability of the adult learners
(Knowles, 1975). This aim is congruent with the use of Problem-Based Learning
(PBL) as a teaching strategy in health-related disciplines (Barrows & Tamblyn, 1980).
PBL describes that learning results from the process of a group of students working
together towards the understanding of a resolution to a problem that they encountered
first in the learning process (Barrows & Tamblyn, 1980). Through the experience of
solving problems, students are urged to develop their content knowledge, self-directed
learning, and thinking strategies such as reasoning skills and critical thinking
(Barrows & Tamblyn, 1980; Hmelo-Silver, 2004). Empirical evidence supports the
usefulness of PBL in both traditional classrooms (Kocaman et al., 2009; Williams,
2004) and e-learning environments (Woltering, Herrler, Spitzer, & Spreckelsen, 2009).
The intention underlying the use of SDL in undergraduate nursing curricula is to
prepare graduates to be lifelong learners and to be fully functional in clinical settings
(Fisher, King, & Tague, 2001; Patterson et al., 2002; Williams, 2001).

1.2 The significance of this current research

The current research is significant in identifying an alternative effective teaching
approach aimed at improving the information literacy and self-directed learning of
ADN students in Taiwan. The rationale for undertaking this study is three fold.
Firstly, information literacy/searching skills education for ADN students in Taiwan is significant as the number of students per year enrolled in this program is close to students enrolled in a BSN degree program (Lin Chia-Chin 林佳靜 et al., 2008) and more than half (approximately 57%) of the nursing workforce graduated from an associate degree program (Yeh Chang Mei 張媚 & Chao Yu Yu-Mei 余玉眉, 2010). When one considers that nurses form the greatest proportion of the primary health care workers (approximately 42.2%-69.3%) all over the world (World Health Organisation (WHO), 2010) this significance is put into greater perspective. In Taiwan, over half (53%) of the health workforce are nurses (Mei Chang & Yu-Mei Chao (Yu), 2008). Hence the quality of health care and patient safety heavily depends on the competency of these nurses (Bodin, 2007); in turn, two of the required nursing competencies are information literacy and life-long learning (ANMC, 2006; Taiwan Nurses Association 台灣護理學會, 2009).

Secondly, in this age of exponential information increase, information literacy has become a required competency for nurses in Taiwan and other countries to support self-development and lifelong learning (ANMC, 2006; Taiwan Nurses Association 台灣護理學會, 2009). Information literate nurses have been found to be able to effectively locate the latest information through the use of library databases to support their EBP (Pravikoff, 2003; Pravikoff et al., 2005; Shorten et al., 2001; Skiba, 2005). Similarly, several studies conducted in Taiwan have highlighted that the rapidly increasing complexity of clinical practice makes effective searching for up-to-date information compulsory for nurses to support their clinical decision-making (Lin Ming-chen 林明珍, Chang Chin-nan 張慶南, & Hsu Li-ling 許麗玲, 2004). It is argued that the quality of nursing care and patient outcomes will increase when nurses employ EBP in their clinical practice (Heater, Becker, & Olson, 1988; Penz & Bassendowski, 2006). Thus, information literacy education for nursing students is essential. Despite this reported acknowledgement in the Taiwanese context, there is limited empirical research that identifies the effectiveness of information literacy education for ADN students in Taiwan. Thus, the current
research is essential for nursing educators in Taiwan in supporting the development and testing of an effective method for developing ADN students’ information literacy learning that can be incorporated into the curriculum.

- Thirdly, self-directed and life-long learning are compulsory for all nursing professionals. As a result, self-directed learning approaches such as e-learning have become alternative approaches for continuing professional education in many countries, including the USA (Parsons, 2006), the UK (Howatson-Jones, 2004) and Taiwan (Liang & Wu, 2010; Yu & Yang, 2006). In order to prepare nursing students to become life-long learners, understanding how SDL can be encouraged and nurtured through the use of e-learning activities is crucial for educators. As ADN students in Taiwan engage in a five-year program, they are typically younger than BSN students in their first three years of the program. However, the age of the four-year Associate Degree students is similar to the first year of university students. Hence the need to support their independence in learning is particularly important.

This study as outlined in section 1.1.5 is informed by KALT. Therefore, this study contributes to existing education research in that it provides empirical evidence supporting the usefulness of KALT outside of the Caucasian context where complementary research has typically been undertaken. KALT has become popular within nursing education in the USA, UK, and Canada because it is founded on a humanistic philosophical stance and is informed by the assumption that adults are self-directed learners and valued in terms of being respected, supported, and accepted as learning partners (Davis & Schrader, 2009; Gabbert & Sims, 2007; Textor & Porock, 2006; Ward & McCormack, 2000). However, little nursing education research has focused on the Asian student context which, given the challenges in Taiwanese nursing education outlined earlier, are in need of being addressed.

KALT provides a theoretical foundation for examining information literacy learning through the use of PBL and experiential learning approaches aimed at improving students’ clinical practice competencies (Andrighetti, Knestrick, Marowitz, Martin, & Engstrom, 2012; Feingold et al., 2004; Hessig, Arcand, & Frost, 2004; Lamiani & Furey, 2009; McKenna, O'Brien, & O'Shea, 2011; Textor & Porock, 2006). As these
approaches to learning, facilitated within an e-learning context, are popular in Taiwan (Hsu Min-Yu 徐銘玉, Tang Lee-Chun 湯麗君, & Huang Chuan-Fang 黃川芳, 2005; Tseng Hui-Chen 曾惠珍 et al., 2006), the selection of KALT is appropriate for shaping and informing the research design in this study. Chapter 3 presents an in-depth critique of KALT and argues for its usefulness in nurse education research and supports the selection of this theory in guiding the current study, its aims, purpose, and objectives.

1.3 Research purpose and objectives

The goal of this study was to identify whether, and, if so, to what extent, the knowledge and skills to conduct information searches and the self-directed learning of nursing students in Associate Degree Programs in Taiwan could be improved by comparing the effectiveness of a web-enhanced education with the usual face-to-face teaching approach. An important focus for nursing education is information literacy. The effectiveness of integrating e-learning into its teaching is unclear. The aim was to identify whether web-enhanced education resulted in an improvement in students’ online searching knowledge, skills, self-efficacy, and self-directed learning when compared with face-to-face instruction. The intervention was guided by KALT and PBL.

Overview of project

A mixed methods intervention design was used with focus groups following pre- and post-test surveys. The experimental group experienced web-enhanced education and the control group had the usual face-to-face teaching. The use of both qualitative and quantitative data was considered most appropriate because it provided a more comprehensive understanding of the research phenomena (Cohen & Manion, 1994; Creswell., 2009; Holloway & Wheeler, 2010; Trochim, 1999). The sample included 142 fourth year ADN students from Meiho University in Taiwan participated through cluster randomization.
1.3.1 Research questions

Five research questions were developed and informed by the literature for this study to evaluate the effectiveness of the use of web-enhanced education to teach ADN program students in Taiwan how to conduct online searches of academic databases:

1. What was the level of the ‘online search knowledge’ of the control group and the experimental group before and after the intervention period?
2. What was the level of the ‘online search skills’ of the control group and the experimental group before and after the intervention period?
3. What was the level of the ‘online search self-efficacy’ of the control group and the experimental group before and after the intervention period?
4. What was the level of the self-directed learning readiness of the control group and the experimental group before and after the intervention period?
5. What was the effect of an educational intervention on the online search knowledge, skills, self-efficacy, and self-directed learning readiness of ADN students in the intervention cohort compared to ADN students who received usual instruction?

1.4 Structure of the thesis

This thesis begins with background information on web-enhanced education, associated skills, and nursing education in Taiwan, particularly Associate Degree programs. The rationale, research purpose, and research questions, together with an introduction to the theoretical basis of the study, are presented.

Chapter 2 presents a critical review of current health education related literature in three specific areas; e-learning, self-directed learning, and information literacy. The associated findings, different methodologies, the various measurement instruments used, and the limitations of various studies are discussed.

Chapter 3 provides a rationale and justification for the use of Knowles’ Adult Learning Theory as the theoretical framework for the current research. This chapter
Chapter 4 presents and discusses the methodology used in conducting the study. The research design is identified and sampling methods are described. The instruments used to measure dependent variables are justified and explained and the research procedure is outlined. Data analysis methods used to analyze both the quantitative and qualitative data are described. Finally, ethical considerations are examined.

Chapter 5 presents the data collected and the subsequent analysis of both the quantitative and qualitative data, which aimed to identify the impact of two different teaching methods on Taiwanese ADN students’ research knowledge, skills, self-efficacy, and their readiness for self-directed learning. These results are discussed in Chapter 6, with reference to the current literature.

Chapter 7, the final chapter, describes the conclusions drawn from the current study highlighting the knowledge contribution. The limitations of this current study, conclusions drawn from data analysis, and recommendations for future research are discussed. The implications for nursing education are examined and recommendations for education, research, and practice in nursing are suggested.
Chapter 2: Literature review

This chapter presents a review of the literature that explores a range of topics related to the use of e-learning and web-enhanced education strategies to promote self-directed learning and information literacy within the health discipline. The associated findings, different methodologies, the various measurement instruments used, and the limitations of various studies are discussed. They were subsequently used to inform the design of the current study.

2.1 Background

Learning methods in the higher education sector are adapted continually in response to cultural changes and the development of technology. The developments in information computer technology have brought about an extraordinary proliferation in the amount of information available from electronic sources. Consequently, ensuring that students have the knowledge and skill set to enable them to search effectively for and to retrieve information from a variety of sources has now become a fundamental essential goal at all levels of education in all disciplines.

“Information literacy” refers to an individual’s ability to utilize information technology to locate, evaluate, and use information in an ethical manner (Brettle & Raynor, 2013). Information literate individuals know how to learn in this way and are prepared for lifelong learning. Having information literacy skills multiplies one’s opportunities for lifelong learning through self-directed learning, which is a great advantage for students (Chaiyama, 2013). Self-directed learning (SDL) is, of course, a complex phenomenon with many key factors, in particular, self-management, self-monitoring, and motivation to learn (Garrison, 1997).\(^5\) Knowles’ Adult Learning Theory (KALT) informs the theoretical framework guiding this study.\(^6\) KALT is founded on a humanistic philosophical approach and the assumption that adults are

\(^5\) There are a cluster of terms associated with SDL: learner-centredness, self-planned learning, self-teaching, autonomous learning, independent learning, and independent studying (Murad & Varkey, 2008; Tennant, 2006).

\(^6\) Knowles’ Adult Learning Theory (KALT) is discussed in detail in Chapter 3.
self-directed learners. An explicit description of SDL was given by Knowles over four decades ago (1975). He defines it succinctly as:

“a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes” (Knowles, 1975, p.18).

This definition of SDL describes the design, conduct, and evaluation of learning as being directed by the learners. Fisher, King, and Tague (2001) equated SDL with the amount of responsibility that the learner accepts for their own learning. SDL requires a maturational process in which students develop the self-directedness that is a fundamental goal of adult Learning (Knowles et al., 2005). A learning environment underpinned by KALT is widely considered to facilitate the development of learners who are more active, engaged, competent, autonomous, and responsible (Davis & Schrader, 2009; Gabbert & Sims, 2007; Textor & Porock, 2006; Ward & McCormack, 2000), but additional factors and influences need to be considered to understand contemporary adult learning practices.

Information literacy has becoming a key component of higher education programs (Meyer et al., 2008), including those in the nursing discipline, in nations such as Australia, New Zealand, the UK, and the USA (American Library Association, 2000; Lupton, 2004; SCONUL, 1999). Nursing educators stress the importance of research and the value of research evidence because of the world-wide trend for evidence-based nursing practice. Information literacy skills are fundamental to the practise of evidence-based nursing (Mollon et al., 2012; Pravikoff et al., 2005; Thiel & Ghosh, 2008). This indicates their understanding of the importance of information literacy education within the nursing discipline, in particular, in the fundamental area of accessing the high quality research material readily locatable in professional library databases for use in nurses’ everyday clinical practice (Burns & Foley, 2005).

Information literacy in education has multiple dimensions, including the need for

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7 The term ‘adult learning’ is used to describe activities that aim to develop learners’ lifelong and self-directed learning attitude (Knowles, 1970).
generic skills, information skills, and an examination of values and beliefs (Lupton, 2004). However, most important is the demonstration of individuals’ critical discernment in using information to solve problems through these activities. Generic skills, including critical thinking and problem-solving, are important as they enable people to interact with computer technology to find information that is useful and relevant to them (Lupton, 2004; McClure, 1994). The term “information skills” broadly refers to competency using technology to locate and use information (Lupton, 2004). This set of skills is related to individuals’ computer skills and basic library skills; at the same time, the development of information literacy is based on this set of skills (SCONUL, 1999). Lupton’s “examination of values and beliefs” relates to using information wisely and ethically, and being socially responsible (Lupton, 2004). Information literacy requires an awareness of appropriate values and beliefs regarding the access and use of information.

The use of multiple educational methods, such as inquiry-based, problem-based, and resource-based learning, has been recommended for delivering information literacy education (Lupton, 2004). These approaches “create opportunities for self-directed and independent learning where students become engaged in using a wide variety of information sources to expand their knowledge, construct knowledge, ask informed questions, and sharpen their critical thinking” (Lupton, 2004, p.6). Empirical evidence supports the use of problem-based learning (PBL) in promoting nursing students’ content knowledge, self-directed learning (Kocaman et al., 2009; Tseng Hui-Chen 曾惠珍 et al., 2006), and thinking strategies, such as reasoning skills and critical thinking (Ozturk, Muslu, & Dicle, 2008; Tiwari, Lai, So, & Yuen, 2006).

PBL creates a learning environment that enables students to construct learning through a process of group interactions, working towards the understanding of a resolution of a problem that is first encountered in the learning process (Barrows & Tamblyn, 1980). In fact, PBL places an emphasis on problem-solving based on experiential learning (Lupton, 2004). This approach is consistent with that of Knowles’ Adult Learning Theory (2005), which assumes that adults actively learn information

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8 “Generic skills include problem solving, collaboration and teamwork, communication and critical thinking” (Lupton, 2004, p.7).
to solve problems encountered in real life and that their learning will be optimized if they have had relevant experience. Traditional approaches to PBL are in the form of face-to-face sessions with a tutor. Crawford (2011) describes various benefits that online PBL can offer when used in preparing nursing students for SDL: “It provides flexibility, opportunities for discussion and co-participation, encourages student autonomy, and allows construction of meaning, as the problems mirror the real world” (p.124).

Comrie (2011) argued that technology is now required for higher education institutions to become “edgeless universities”, and that this includes incorporating technology “to generate radical changes to … programme designs [to] enable flexible access” (p.250). “Technology-enhanced learning” is a relatively recent term for teaching methods that integrate computer technology and the Internet to support learning (Parsons & Griffiths, 2007; Tait et al., 2008). Tait, Tait, Thornton, and Edwards (2008) also list several other terms used to describe what is essentially the same activity: computer-based learning; computer-assisted instruction; and electronic learning (e-learning). E-learning can be divided into “web-based learning”, which is online learning, and “web-enhanced learning9”, depending on the degree of Internet learning activities involved.

There is empirical evidence that e-learning can effectively promote nursing students’ critical thinking (Ali, Hodson-Carlton, & Ryan, 2004; Kenny, 2002), their computer skills (Creedy, Mitchell, Seaton-Sykes, & Cooke, 2007), and their self-regulation (Chen et al., 2009; Mitchell et al., 2007). Furthermore, information computer technology (ICT) tools have been used effectively to broaden the learning experience of students in the health disciplines; these tools include e-mail (Kerfoot et al., 2010), discussion boards (Dunfee, Rindflesch, Driscoll, Hollman, & Plack, 2008), interactive multimedia (Maag, 2004), and videos (Bloomfield, Roberts, & While, 2010; Oermann et al., 2010; Salyers, 2007).

Masalea (2009) found that a hybrid approach, combining traditional on campus face-to-face instruction with online learning, offered several potential benefits for students:

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9 “Web-enhanced learning” is a hybrid teaching approach that consists of traditional face-to-face instruction and online learning.
improving pedagogy, encouraging student engagement, and increasing flexibility in both teaching and learning. A hybrid approach can effectively improve the learning of medical students (Maley, Harvey, de Boer, Scott, & Arena, 2008) and nursing students (Gagnon, Gagnon, Desmartis, & Njoya, 2013). The positive benefits were considered to be a result partly of this format satisfying a broader range of learning style preferences among the students (Maley et al., 2008). This approach also avoids the disadvantage of isolation often associated with a fully online learning approach (Thorne, 2003).

The next section outlines the strategies used to search the relevant literature regarding the use of PBL and e-learning in promoting nursing students’ information literacy and SDL.

2.1.1 Searching strategy

The material examined was initially obtained from four English language databases:

1. Cumulative Index of Nursing and Allied Health Literature (CINAHL);
2. Medline;
3. Education Resources Information Center (ERIC); and
4. SCOPUS,

and from two Chinese language databases:

1. Index to Taiwan Periodical Literature database at the National Library of Taiwan\(^{10}\); and
2. Airiti Library\(^{11}\).

A search of each database was conducted for journal articles in the four key interrelated topic areas below, using the English search terms alphabetically listed and/or their corresponding Chinese search term:

\(^{10}\) 臺灣期刊文獻資訊網 - 臺灣期刊論文索引系統 (literally “Taiwan Periodical Information Center - Index to Taiwan Periodical Literature System”) is a National Central Library database of journal articles, theses, and dissertations published in Taiwan, in Chinese and in English.

\(^{11}\) Airiti Library 華藝線上圖書館 is the commonly used name for the Chinese Electronic Periodical Service (CEPS). This is a database of Chinese and English language journal articles, theses, and dissertations published in Taiwan, Hong Kong, and mainland China.
1. Web-enhanced education, using the keywords: blended learning 混成式學習; computer-assisted instruction 電腦輔助教學; e-learning 數位學習; hybrid learning 混成學習; online learning 網路學習; web-based learning 網路學習; web-enhanced learning 網路輔助學習.
2. Self-directed learning, using the keywords: lifelong learning 終生學習; problem-based learning 問題導向學習; self-directed learning 自我導向學習.
3. Nurses’ EBP skills, using the keywords: information literacy 資訊素養; information searching 資訊尋求; information seeking 資訊尋求.

The initial inclusion criteria used to select journal papers were papers that were:
1. a peer reviewed research article;
2. written in English or Chinese;
3. published between 2005 and 2014; and
4. with a health education focus.

Figure 1 depicts the flowchart of the initial search of databases. The search strategy generated 7,050 potentially relevant articles from the databases. On the basis of their bibliographic information, 6,787 articles were excluded because of duplication (n = 74) and not meeting the inclusion criteria (n = 6,713). This left 263 studies identified as potentially suitable for including in the review and for which the full-texts were requested; only 239 articles with full text were available. These retrieved articles were then read and the majority were rejected because they were not research articles focused on the teaching effectiveness in promoting information literacy education and SDL in students in the health discipline; nor were they empirical studies in identifying the teaching effects of e-learning in the above mentioned areas. Finally, a total of 63 articles were identified for this review.

Additional sources were selected from the reference listings of the papers found through the databases searches. These additional sources included other journal
articles; unpublished master’s and doctoral theses in English and in Chinese; and material from nurses’ professional associations and from government websites in Australia and Taiwan.  

Data sources searched
- CINAHL = 753 hits
- Medline = 1,390 hits
- ERIC = 1,676 hits
- SCOPUS = 2,229 hits
- Chinese databases = 1,002 hits

7,050 records identified from bibliographic databases

6,778 records excluded because of duplication and not meeting the inclusion criteria

272 titles and abstracts screened

176 records discarded because text was inappropriate, for example, not educational interventions focused on health discipline students

239 articles full text available

63 articles in this review

Figure 2. Initial database search flowchart

The importance of information literacy for nurses stems from the implementation of evidence-based practice (EBP), which requires nurses to obtain quality current research from reliable resources to support their clinical decision-making and, in turn, to support patient safety and effective health care (Pravikoff et al., 2005). However, many nurses encounter difficulties in locating information using databases, which highlights the challenge in developing nursing students’ online searching skills (Dee & Stanley, 2005). There is a negative (diminishing) correlation between nurses’ inadequate knowledge and skills in using library databases and their online searching self-efficacy belief (Beile & Boote, 2004; Monoi, O’Hanlon, & Diaz, 2005). In order to promote nursing students’ information literacy and SDL, teaching methods should encourage students to be independent and responsible learners and should stimulate students’ critical thinking and problem-solving abilities (Lupton, 2004). E-learning and PBL match these needs in promoting students’ information literacy and SDL. In

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12 For example, the website of the Australian Nursing and Midwifery Accreditation Council (ANMAC) website. http://www.anmca.org.au/
fact, a number of factors contribute to students’ readiness for SDL. A low level of student SDL readiness indicates the need for additional teaching support in preparing these students for SDL.

Therefore, with consideration of the above, the following three key areas emerged from an analysis of the articles:

1. Nursing students’ readiness to learn to be information literate and their preparedness for EBP;
2. The importance of matching teaching methods to the learning needs of nursing students in order to promote their critical thinking, problem-solving ability, and self-directedness;
3. Learning motivation is necessary to nurture independent learners who are active learners and responsible for their own learning.

Overall, the literature examined indicates that the development of individuals’ information literacy involves three areas of learning: 1. generic critical thinking and communication skills; 2. information skills; and 3. values and beliefs in relation to the use of appropriate information. Teaching strategies informed by the principles of adult learning, such as PBL and e-learning, were found to be appropriate for promoting nursing students’ critical thinking and SDL. Finally, information literacy and self-directed learning prepared people to become lifelong learners, and this contributed to professional practice in clinical settings.

2.2 Nursing students’ readiness for information literacy

2.2.1 Quality of information & evidence-based nursing practice

The nursing profession has recognised the importance of undertaking research and the value of research evidence to improve clinical care; as a result, clinical nurses are encouraged to adopt EBP (Cullum et al., 2008; Mollon et al., 2012). The “conscientious, explicit and judicious use of theory-derived, research-based information [is essential for] making decisions about care delivery to individuals or groups of patients… [taking into account] … individual needs and preferences”
(Ingersoll, 2000, p.152). There is a seven-level hierarchy of evidence in EBP for assessing the effectiveness of an intervention or treatment (Melnyk & Fineout-Overholt, 2005). An understanding of these levels of evidence is essential in informing student and health professionals about the relevance of particular research to their situation. They range from level 7, which contains opinions of authors and expert committees, to level 1, the highest level of evidence, which includes the systematic review of randomization control trials (RCT) and non-randomized trials (Polit & Beck, 2012). Level 1 evidence is generally retrieved by online searching of websites (for example, Cochrane Library) and computer databases of online journals (Secco et al., 2006) so high level retrieval skills are imperative.

The next section discusses nursing professionals’ information seeking and use of information resources in promoting daily clinical nursing care.

### 2.2.2 Information resources used & online searching self-efficacy

The findings of a number of studies that have examined nurses’ readiness for EBP suggest that nursing professionals had the ability to engage in basic information gathering but not higher level evidence gathering; thus, they were not well prepared for incorporating EBP into their everyday patient care (Koivunen et al., 2010; Pravikoff et al., 2005; Thiel & Ghosh, 2008). Nurses and undergraduate students in many countries used interpersonal information sources, such as nursing colleagues and other healthcare professionals, and print sources, such as textbooks, to support their clinical decision-making and learning more frequently than they used electronic sources. This practice was evident in countries including Ireland (O’Leary & Mhaolrúnaigh, 2012), the UK (Franks & McAlonan, 2007), New Zealand (Hider, Griffin, Walker, & Coughlan, 2009), Singapore (Majid et al., 2013), and Taiwan (Chang Chin-Nan 張慶南 et al., 2007).

Although some nurses in Australia (Secco et al., 2006), Canada (Wahoush & Banfield, 2014), the USA (Campbell & McDowell, 2011; Pravikoff et al., 2005), and Taiwan

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13 The second character of Chang Chin-Nan’s Chinese character name, 張慶南, has been incorrectly translated, giving her name as “Chang Chen-Nan” in a number of publications and abstracts.
(Weng et al., 2013) used bibliographic databases such as PubMed, CINAHL, or Airiti Library to find specific information for clinical practice, the frequency was far lower than their use of the Internet and the World Wide Web (WWW). This causes problems for EBP because the reliability and credibility of information from the latter are questionable (Child, 2010; Griffith University Library, 2011; Montecino, 1988). The relationship between online searching self-efficacy and information literacy using library databases is outlined in the following paragraphs.

Inadequate retrieval knowledge and skills constitutes one of four main barriers\(^{14}\) that negatively influence nurses’ use of databases (Chang Chin-Nan 張慶南 et al., 2007; Jones, Schilling, & Pesut, 2011; Pravikoff et al., 2005). Nurses with greater computer and searching skills are more likely to use computerized information (Secco et al., 2006). This, in turn, is likely to maintain and increase both their familiarity with this skill and their skill level and confidence. This creates a so-called “virtuous circle”. The terms “online searching confidence” and “online searching self-efficacy” both refer to a person’s confidence level in locating, evaluating, and using relevant information through the use of databases (Monoi et al., 2005). “Low online searching capability” is a term also used in this current study to refer to an inadequate confidence or self-efficacy level in respect of a person’s capability to do these things. A low online searching capability level in nurses is strongly associated with their having inadequate knowledge and skills in this area. Education can effectively strengthen students’ self-efficacy and their competence in using databases (Craig & Corrall, 2007; Monoi et al., 2005; Tarrant et al., 2008).

Increasing a person’s self-efficacy belief level is important as this is an effective predictor for learning achievement (Hampton & Mason, 2003; Magno, 2009; Spence & Usher, 2007; Wilson-Soga, 2009), for motivation (Liang & Wu, 2010; Waldman, 2003), for satisfaction (Liaw, 2007), and for the use of a deep or strategic approach to learning (Prat-Sala & Redford, 2010). Several studies also demonstrated a close relationship between learners’ self-efficacy level, their searching knowledge abilities (Beile & Boote, 2004; Mehrad & Rahimi, 2009; Monoi et al., 2005), and their online information searching skills performance (Tsai & Tsai, 2003).

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\(^{14}\) The four main barriers to the use of databases are: lack of time, limited computer access in the workplace, inadequate computer skills, and inadequate knowledge and skills on retrieval.
According to Bandura (1997), self-efficacy beliefs can be strengthened from four main sources: 1. enactive mastery experiences, such as successful experiences, as indicators of capability; 2. vicarious experiences: a transmission of competencies through comparison of others’ attainment, such as through observation; 3. verbal persuasion and allied social influences, such as others’ praises; and 4. physiological and affective state responses to experiences. There is empirical evidence that clinical staff’s and students’ self-efficacy levels can be enhanced through experiential learning (Andrighetti et al., 2012; McKenna et al., 2011), observation (Parsons, 2007), and verbal and emotional support (Grightmire, 2009). Finally, self-efficacy beliefs may also be influenced by individuals’ age (Chyung, 2007), past performance (Bates & Khasawneh, 2007; Hampton, 1998; Wu Wen-Hsiung 吳文雄, 2002), and prior experience (Hsu & Huang, 2006; Kim, 2005).

The educational need to promote the confidence of Taiwan Associate Degree in Nursing (ADN) students in using databases is discussed in the next section.

2.2.3 Educational needs and challenges for online searching skills

The literature suggests that information retrieval skills education targeting the use of academic databases is one of the most important educational needs of students preparing to practise evidence-based nursing care (Dee & Stanley, 2005; Hao Chia-Chi 郝家琪 & Hsu Li-Ling 許麗齡, 2008; Koivunen et al., 2010; Majid et al., 2013). This is the case too for Taiwanese ADN students. The goal of such education is to give nurses and students the skill set, familiarity with academic databases, and confidence to use higher level evidence more often when planning nursing care.

Nurses and students are eager for more database training (Chang Chin-Nan 張慶南 et al., 2007; Dee & Stanley, 2005). Dee and Stanley (2005) observed that a higher percentage of a small group of postgraduate nursing students in the USA (N = 25) who had been exposed to more learning opportunities and had more practice self-reported competency in computer skills and Internet searching skills compared to a matched group of clinical nurses. However, these students primarily used Google and
Yahoo with the help of subject directories to find medical information - an inferior research technique. In effect, they took excessive time finding the limiters and subheadings and in the end settled for a large number of retrieved articles, even after being given database searching instruction and exercises. A significant detail was that the students self-identified an expressed interest in a one-on-one database education program to assist them in advancing their skills for using PubMed and other databases.

Nurses in Taiwan are also eager for further database education to support their clinical practice; but they show much greater interest in learning to access Chinese databases (39.2%, n = 144) rather than English databases (33.2%, n = 122) (Chang Chin-Nan 張慶南 et al., 2007). Weng et al.(2013) found that Taiwanese nurses (N = 4,206) more often access Chinese databases than English databases in their daily practice. They also found that nurses with a lower academic award (an associate degree or a diploma) wanted to use Chinese databases more so than did nurses with a higher academic degree (a bachelor’s or master’s degree). The language barrier could be a major contributing factor for this finding (Chang Chin-Nan 張慶南 et al., 2007; Hao Chia-Chi 郝家琪 & Hsu Li-Ling 許麗齡, 2008; Weng et al., 2013). Other studies conducted in English native-speaking countries indicated that achieving searching mastery using academic databases was a challenge for both nursing students (Dee & Stanley, 2005) and medical students (Bronander, Goodman, Inman, & Veach, 2004), even when they are searching using their mother language. For this reason, this current research project, assessing the effectiveness of using a web-enhanced educational package to improve the learning of online research skills for ADN students in Taiwan, focuses on the critical skills these students need to retrieve information from Chinese databases.

Information literacy skills are complex and cognitively challenging skills that need repeated application and practice to achieve mastery (Mery, Newby, & Peng, 2012). Studies report finding student weaknesses in identifying keywords (Chen Lin Ching 林菁, 2008; Craig & Correll, 2007; Duncan & Holtslander, 2012). Databases are optimized for Boolean searches, but the literature indicates that students in different disciplines have difficulties in using Boolean operators; this includes students of nursing (Hao Chia-Chi 郝家琪 & Hsu Li-Ling 許麗齡, 2008; Majid et al., 2013).
students of medicine (Bronander et al., 2004), and students doing an arts degree (Salisbury & Ellis, 2003). A study in the USA (Bronander et al., 2004) reported that medical students (n = 49) demonstrated weakness identifying optimal Boolean phrases. They had more difficulty identifying the best phrase when it contained the operators “OR” or “NOT” than when all terms were linked with “AND”. Similarly, nurses in Singapore (N = 1,486) were not familiar with Boolean operators; as a result, only 13% of the participants correctly picked up an appropriate search statement (Majid et al., 2013). This is also true for Australian undergraduate arts faculty students (N = 282). They had moderate levels (71%) of online searching knowledge but had low levels of ability (26%) in using Boolean Operators correctly to complete a search statement after receiving one hour of information literacy education (Salisbury & Ellis, 2003). These findings suggest that information literacy education needs to offer more opportunities for students to integrate advanced searching skills, such as Boolean logic, into searching statements. Nursing students encounter similar difficulties in identifying appropriate words or phrases to query databases (Craig & Corrall, 2007; Duncan & Holtslander, 2012). One Canadian study reported that nursing students (N = 11) encountered difficulties in identifying appropriate words or phrases to query databases (Duncan & Holtslander, 2012). The students experienced frustration when trying to find fruitful words or phrases to form a search statement to find relevant information. At times, the words and phrases were simply beyond their lexical experience (Duncan & Holtslander, 2012). In the UK, Craig and Corrall (2007) also reported a low correct response in selecting search terms, and the use of truncation was found in Diploma of Higher Education (DipHE) nursing students (n = 29). Chen Lin Ching 林菁 (2008) reported a similar situation: 34 Taiwanese undergraduate students from a range of disciplines who had received a two-hour instruction class had difficulty in identifying appropriate keywords to find relevant information with an adequate number of search hits, even though a Chinese database was used. All these findings indicate that students need additional support to find appropriate searching words and phrases.

The current literature (Craig & Corrall, 2007; Mery et al., 2012; Salisbury & Ellis, 2003) also suggests that a longer period of instruction is required for students with
limited experience to master information literacy as its concepts are complex and challenging. A study in the USA by Mery et al. (2012) found that the information literacy of English department students \((n = 32)\) who received one short teaching session (50 minutes) did not increase as greatly as it did for other students \((n = 570)\) who undertook an online credit course. However, caution needs to be taken with findings from just a small sample, and the above findings may not be transferrable to ADN students in Taiwan: The participants were in bachelor programs, in other disciplines, and in different countries.

In summary, there is evidence that nursing students and nurses lack the skills to conduct an effective searching strategy. A lack of the research skills to use databases disadvantages nurses’ fundamental EBP and, consequently, has great potential to compromise the quality of care they are able to give their patients. To date, little research has targeted the research skills of the nursing students in ADN programs in Taiwan, the programs from which a great portion the current nursing workforce in Taiwan has graduated (Yeh Chang Mei 張媚 & Chao Yu Yu-Mei 余玉眉, 2010). For this reason, this current research project was designed as an educational intervention to assess the effectiveness of employing a web-enhanced educational package to improve the learning of online research skills for ADN students in Taiwan, in particular, the critical skills these students need to retrieve information from Chinese library databases. The optimum teaching strategies for meeting the information literacy needs of the ADN students in Taiwan are discussed in the next section.

### 2.3 Matching teaching methods with learning needs

#### 2.3.1 Technology-enhanced learning

In the past decade there has been an increasing emphasis on the need for nursing educators to adapt their teaching styles to accommodate the learning needs of students born into the Net Generation (Billings, 2004; Mangold, 2007; Pardue & Morgan, 2008; Skiba & Barton, 2006). Students born between 1982 and 2004 are part of the so-called “digital natives” generation; also called “Generation Y”, or “Millennials”, or the “Net Generation” (Chang & Gütl, 2010; Skiba & Barton, 2006). They are
proficient users of technology, prefer to learn by doing (experiential learning), and learn best solving problems through collaborative work (Mangold, 2007). Mangold (2007), and Pardue and Morgan (2008) argue that nursing academia should be aware of the practical implications of the sometimes wide age gap between nursing faculty staff and their Net Generation students when evaluating the suitability of teaching approaches.

The integration of technology into nursing education is helpful for preparing all nursing students to become competent with information and communication technology (ICT) (Dunfee et al., 2008). This also encourages them to engage in deep learning through online team-based collaborative learning (Shen, Hiltz, & Bieber, 2008), which is essential for self-directed learning (Beadle & Santy, 2008; Bloomfield et al., 2010). This approach has been widely adopted by nursing schools and hospitals in Australia (Creedy et al., 2007), Canada (Gagnon et al., 2013), Korea (Sung et al., 2008), New Zealand (McKenna et al., 2011), Taiwan (Hsu & Hsieh, 2011; Liang & Wu, 2010), and the USA (Thompson et al., 2011). This approach has been found useful in a range of settings, including formal education (Thompson et al., 2011), clinical placement (Tait et al., 2008), and continuing professional development (McKenna et al., 2011).

Research has indicated that technology-enhanced teaching was related to the enhancement of students’ SDL (Mitchell et al., 2007; Salyers, 2005), critical thinking (Dunfee et al., 2008; Kenny, 2002), learning satisfaction, and self-efficacy in performing nursing skills (Du et al., 2013). These findings indicate that the integration of e-learning into traditional face-to-face instruction more closely matches learners’ needs (Nkenke et al., 2012). Students appear to like the flexibility of an online approach (Crawford, 2011). An online approach allows them to access the learning content anywhere and at a time of their choice; and students’ SDL readiness improved after a combination of online learning activities (Mitchell et al., 2007; Salyers, 2005). Mitchell, Ryan, Carson and McCann (2007) reported that 69.9% (n = 178) of undergraduate nursing students in the UK who completed a short survey agreed that they gained personal control of learning through a web-enhanced approach. The students reported that they were “able to plan home and study workloads”, and that they “valued knowing exactly where to get all module information” (Mitchell et al.,
2007, p.2, 293). Similarly, Salyers (2005) identified that postgraduate nursing students in the USA, using a web-enhanced approach to learning, reported that they had greater independence and self-paced learning compared to students who were not given a web-enhanced approach. There are strong indications that SDL readiness and student independence can be enhanced through self-paced online learning, but more evidence from a wider perspective is needed. A shortcoming of these studies is that the findings were mostly based on qualitative research and/or with small sample sizes, thus reducing their generalizability to different participants and learning settings (Johnson & Onwuegbuzie, 2004). A mixed methods approach could better assess the self-directed learning readiness of students in relation to a web-enhanced learning program.

A small study completed by Nkenke et al. (2012) included an additional spaced education\textsuperscript{15} component to traditional face-to-face lectures in a dental students’ theoretical radiological science course, and compared this group \((n = 21)\) with a control group \((n = 21)\) who were only given face-to-face instruction. The students in the spaced education group rated their needs as significantly better met than those in the traditional class group \((p = .034)\). The students in Nkenke et al.’s (2012) study reported that they liked the way the questions were sent out to them individually by e-mail and felt that it improved their knowledge in the field. There is also evidence indicating that online spaced education can improve medical students’ knowledge acquisition (Kerfoot et al., 2009), and knowledge retention (Kerfoot et al., 2010), and that it encourages them to spend more time keeping up to date with learning content compared to traditional face-to-face instruction (Nkenke et al., 2012; Shaw, Long, Chopra, & Kerfoot, 2011). However, the participants in these studies were not nursing students; no studies have examined the effects of using spaced education for students of nursing.

Critical thinking is an important element of knowledge utilization. Students’ critical thinking can be promoted through a technology-enhanced approach (Dunfee et al.,

\textsuperscript{15} “Spaced education” is an innovative, evidence-based form of online education to individualize students’ learning (Kerfoot et al., 2010; Kerfoot, Kearney, Connelly, & Ritchey, 2009). Participants receive short multiple-choice questions and individual feedback via e-mail in a repeating pattern over a number of weeks in response to their self-paced online engagement in the material.
2008; Kenny, 2002). Kenny (2002) reports that a bulletin board provided a more “thoughtful” environment in that it encouraged nursing students in Australia ($N = 21$) to consider their opinions before posting. Moreover, “this safer environment encouraged reticent nursing students’ participation compared to traditional face-to-face learning contexts” (p.132). Similarly, a study of American students ($N = 7$) in another health-related field, physical therapy, by Dunfee et al. (2008) reports that their reflection and higher-order thinking in clinical settings were improved using an electronic discussion board. Although the findings are from studies with extremely small sample sizes, they suggest that an online forum (an interactive communication activity) is a useful tool for promoting students’ critical thinking. The associated abilities contribute to nursing professionals’ information literacy and lifelong learning.

Du and colleagues (2013) conducted a systematic review of nine RCTs with a total of 1,125 participants (sample size varying from 36 to 231) and concluded that participants, including nurses, bachelor and diploma of nursing students, had a high satisfaction rate for e-learning. Importantly, e-learning demonstrated its effectiveness in promoting both the participants’ knowledge and clinical skills performance in three studies. However, the nine RCTs were not homogeneous as there was substantial divergence in the interventions and outcome variables which prevented the authors conducting a meta-analysis. Although e-learning seems to be regarded positively by nurses and students, the majority of reviewed research did not report statistically significant results. Similarly, Maag (2004) reports that nursing students who received multimedia integrated teaching about medication dosage calculation found it enjoyable, and reported greater satisfaction than students in another group for which only text, or text and images, teaching materials were used. A multimedia approach offers a better chance for inexperienced learners to construct multimodal connections (by using concurrent verbal and visual explanations) (Maag, 2004).

In summary, the integration of e-learning into teaching strategies has correlations with varying degrees of enhancement of various aspects of student performance. The suitability of a web-enhanced model for supporting the learning of students in the nursing discipline has also found support.
2.3.2 Advantages of a web-enhanced approach

The literature suggests that a web-enhanced learning model supports nursing students’ learning. Such a hybrid approach has been identified as an effective teaching method (Gagnon et al., 2013) that can improve pedagogy, engagement, and flexibility in both teaching and learning (Masalela, 2009). The use of Web Course Tools (WebCT) has been correlated with augmented students’ SDL (Mitchell et al., 2007; Salyers, 2005), and the use of postings and e-mail with promoting online communications between students and lecturers (Hayward, 2004). At the same time, some face-to-face contact between teacher and students successfully reduces the isolation that often occurs using a fully online teaching/learning approach (Buckley, 2003). A small study in the USA provides a further example, indicating that a hybrid approach satisfies a broader range of student learning style preferences. The nursing students \( n = 23 \) who undertook a nutrition course that was delivered using web-enhanced teaching gave the course higher teaching evaluation scores than did the other students who undertook the same course taught using either a traditional \( n = 24 \) or a web-based \( n = 11 \) teaching method (Buckley, 2003). Comments from the students in both the web-enhanced and the web-based group indicated that a technology-enhanced approach closely matched their learning needs, such as flexibility and adequate teacher presence. An online component allows self-paced learning and offers more opportunities to interact with instructors, using e-mail and a discussion board. However, students also expressed negative feelings towards a fully online learning setting because of the associated social isolation (Buckley, 2003). Although the sample size used in Buckley’s (2003) study was small, the comments from the nursing students indicate that a hybrid approach should be seriously considered.

A quality web-enhanced learning program should be informed by theoretical considerations designed to prompt innovation and student-paced, self-directed learning, and extend learning for those who desire and need it (McAllister & Mitchell, 2002). The absence of an articulated learning theory and principles informing the design of programs incorporating e-learning may result in poor quality instruction, which will adversely affect learning outcomes (Evgeniou & Loizou, 2012). Basic well-established teaching strategies and principles need to be integrated into web-
enhanced learning, including student-teaching contact, cooperation among students, active learning, prompt encouraging feedback, consideration of diverse ways of learning, and clearly articulated expectations about the time to be spent on task (Bangert, 2004; Chickering & Ehrmann, 1996; Graham, Cagiltay, Lim, Craner, & Duffy, 2001). More than 15 years ago, Chickering and Ehrmann (1996) argued that an e-learning program informed by an articulated educational theory would be more likely to support student learning. Knowles’ Adult Learning Theory, which uses problem-solving, life-oriented and group discussion to augment students’ SDL (Knowles et al., 2005), is therefore suitable for guiding web-enhanced learning.

2.3.3 Methods matching students’ information literacy education needs

Teaching methods have also been found to be significant in supporting information literacy.

2.3.3.1 Interdisciplinary collaboration & integration into the nursing curriculum

The effectiveness of information literacy education for nursing students can be augmented through meaningful collaboration between the teaching staff and information literacy experts such as librarians (Janke et al., 2012; Morgan, Fogel, Hicks, Wright, & Tyler, 2007). Collaboration with expert librarians may see a sharing of responsibility: The librarians can teach searching skills such as the use of nursing-related keywords, the use of limits and Boolean logic, and generic critical thinking searching skills (Grafstein, 2002; Miller, Jones, Graves, & Sievert, 2010). As Anderson and May point out, “the teaching staff can assist them expand beyond basic library and research skills instruction and integrate content targeting the students in a specific field of research” (Anderson & May, 2010, p.499).

Interdisciplinary collaboration in information literacy education can be divided into three types: intra-curricula, extra-curricular, and inter-curricula16 (Honey, North, &

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16 In “extra-curricular education” a range of general orientation and education opportunities is provided externally and additionally; for example, in the form of online tutorials, workbooks, and face-to-face sessions. In inter-curricula education the subject librarian (or a person with similar expertise) is invited to present a session or several sessions as part of a course.
Gunn, 2006). The use of an intra-curricula format is recommended for helping nursing professionals to develop information literacy skills to support their decision-making and clinical practice in an ongoing way (Janke et al., 2012; Miller et al., 2010). In the intra-curricula format the teaching of information literacy is embedded within a course—into its content, structure, and sequence. It is subject-related or discipline-related, and is linked to assessment (Honey et al., 2006). In this format, nursing teaching staff can share the task of imparting information literacy skills by setting assignments embedded within the research paradigms and procedures of their discipline (Janke et al., 2012; Turnbull, Royal, & Purnell, 2011). Several studies report clinical scenarios successfully being integrated into clinically relevant assignments; this promotes nursing students’ sense of the relevance of nursing information literacy (Brettle & Raynor, 2013; Courey, Benson-Soros, Deemer, & Zeller, 2006; Ku et al., 2007; Tarrant et al., 2008). Clinical assignments requiring immediate application of information sourced from appropriate databases are a useful strategic tool to help students to meet their course objectives and for developing their information literacy for practice (Flood et al., 2010).

Undertaking a clinical assignment is similar to PBL in that it can be designed to require students to develop a research topic and keywords from the given scenario and then to follow that up by conducting a literature search. As discussed above under section 2.1 Background, inquiry-based and problem-based learning are both appropriate for information literacy education (Hsu L. L. 許麗齡, 2002; Lupton, 2004). These two particular approaches both place an emphasis on experiential learning; students actively seek information and expand their knowledge, and engage in critical thinking. This enhances the skills they need to call on for self-directed learning and this, in turn, enhances their confidence and encourages them.

The effectiveness of PBL to enhance the learning of students within the health disciplines is widely reported.
2.3.3.2 Problem-based learning

PBL and its designed interactive discussions and synthesis of information can potentially move students’ learning approach from a superficial to a deeper form of learning (Wilkie & Burns., 2003). A PBL approach can encourage students to move from passive knowledge acquisition to actively constructing knowledge. As a result, students’ content knowledge, self-directed learning, and thinking strategies—such as reasoning skills and critical thinking—may all improve through the experience of solving problems in a collaborative learning environment (Barrows & Tamblyn, 1980; Hmelo-Silver, 2004). PBL has been correlated with improvements in nursing students’ SDL (Kocaman et al., 2009; Lee, Lin et al., 2010), and in their critical thinking (Ozturk et al., 2008; Tseng Hui-Chen 曾惠珍 et al., 2006). However, prior research does not conclusively establish that PBL undertaken in a traditional physical classroom is effective for promoting the SDL of students from the health disciplines.

Two small studies found a significant increase in students’ SDL levels after PBL (Kocaman et al., 2009; Shankar et al., 2011). Both used the self-directed learning readiness scale for nursing education (SDLRSNE) developed by Fisher et al. (2001) as the measurement instrument. The total SDLRSNE scores of 90 medical students in Nepal significantly improved after a year of a partial PBL curriculum during their clinical practice studies (Shankar et al., 2011). Similarly, 50 Turkish Bachelor of Nursing students’ SDLRSNE scores significantly increased over the course of a four-year curriculum integrating PBL (Kocaman et al., 2009). A Taiwanese study (Lee, Lin et al., 2010) found that the SDL scores of junior nursing students \( N = 96 \) and their group cooperation and satisfaction with themselves and with their group performance all significantly increased after they undertook an eight-week PBL component. The SDL scores of the students in Lee et al.’s study (2010) were measured using a five-item questionnaire adapted from Lee Meng-Chih 李孟智 et al. (2003), which causes difficulty comparing their findings with other studies in the literature that used other measurement instruments. In addition, and more importantly, each of these three studies only used a one-group pre- and post-test design; consequently, the results reported are compromised as this is a less rigorous research method resulting in reduced research validity (Nieswiadomy, 2012).
Another small study in Taiwan with a control and intervention groups reported that Bachelor of Nursing students \((n = 30)\) who undertook a PBL integrated course had higher SDL scores than the control group \((n = 30)\) who did not engage in PBL (Tseng Hui-Chen 曾惠珍 et al., 2006). The difference between the scores of the two groups was not statistically significant. This could be a result of the non-traditional demographic of the nursing students who were mature-aged (between 23 and 43 years) and had considerable nursing experience \(\text{mean} = 5.91\) years, \(\text{SD} = 4.52\). The part played by the PBL might have been far outmatched by the effect of the experience that both groups shared – their real-life experience can be considered a form of PBL. Apart from this major factor, the SDL scores were measured using a questionnaire adapted from McMaster University in Canada without reporting details of its reliability and validity. Once again, this different questionnaire creates difficulties in making any comparisons with the results of other studies.

In contrast to the findings from the studies above, three studies discussed below found that the SDL levels of undergraduate nursing (Wiley, 1983; Williams, 2004) and pharmacy (Walker & Lofton, 2003) students did not increase after PBL in traditional classroom settings but instead remained at a plateau or decreased. A factor worth mentioning is that the Self-Directed Learning Readiness Scale (SDLRS) developed by Guglielmino in the 1970s was used as the questionnaire in these three studies. The construct validity of Guglielmino’s SDLRS has been questioned (Bonham, 1991; Field, 1989; Hoban, Lawson, Mazmanian, Best, & Seibel, 2005), and Fisher et al. (2001) report that Field (1990) and Candy (1991) suggested discontinuing use of this tool because of the problems with its validity. The seemingly contradictory results from these studies may be due to the use of this particular measurement instrument. Williams (2004) did not find any statistically significant increase in the SDL scores of Canadian Bachelor of Nursing students \((N = 135)\) after they had completed one year of a curriculum integrating PBL, but the students reported that they had developed many characteristics associated with SDL, including a perceived greater amount of control in choosing learning information important to them, and a sense of responsibility associated with and confidence about being a nurse. Similarly, in a much earlier study, Wiley (1983) did not find that the SDL scores of bachelor’s
degree nursing students \((n = 50)\) in the USA, whose course included a 12-hour process-oriented SDL project, were statistically significantly higher than the scores of students in the control group \((n = 54)\). However, among students with particular personality types who preferred a lower degree of structured curriculum, a significant increase was found in the post-test SDL scores of students in the SDL intervention group in comparison with those in the control group who also preferred a lower degree of structure. Wiley concluded that it was these students’ preference for the lower amount of structured learning that contributed to the increase in their post-test SDL readiness. Walker and Lofton (2003) measured the SDL scores of American pharmacy students \((N = 73)\) before a 16-week PBL curriculum, at the eighth week, and at the conclusion in the 16th week. Surprisingly, they found a statistically significant decline in the scores of all students after eight weeks and also after 16 weeks of PBL. Walker and Lofton highlight the importance of identifying students’ difficulties and providing them with adequate support to become accustomed to and motivated about SDL, in particular, at the introductory phase of a PBL program. Finally, once again there was no control group – a common limitation of many studies.

Many of the above findings had a small number of participants (Kocaman et al., 2009; Shankar et al., 2011; Tseng Hui-Chen 曾惠珍 et al., 2006; Walker & Lofton, 2003) and/or no control group (Kocaman et al., 2009; Lee, Lin et al., 2010; Shankar et al., 2011; Walker & Lofton, 2003; Williams, 2004), therefore, their results cannot be generalized, and no reliable conclusions can be drawn about the actual impact of traditional face-to-face PBL on students’ learning. Nevertheless, they generally indicate the usefulness of integrating traditional face-to-face PBL into the curriculum. There are similar indications in the literature that an online setting is suitable for PBL.

An online setting provides more flexibility and opportunities for discussion and co-participation than PBL in a traditional face-to-face setting (Crawford, 2011). Horng Meei Ling 洪美齡, Huang Wen Wen 黃雯雯, & Wang Wen Ching 王文景 (2010), for example, reported that Taiwanese undergraduate medical students complained that it was difficult for them to join group face-to-face interactions, whereas online participation would have been possible. There is empirical evidence that online PBL can more effectively promote students’ learning (Taradi, Taradi, Radić, & Pokrajac,
2005), engagement (Dennis, 2003), and satisfaction (Woltering et al., 2009). In one study, medical students \( n = 37 \) in Croatia who undertook online PBL for an acid-based physiology unit had statistically significant improvements in scores compared to the scores of students \( n = 84 \) who undertook the PBL using a traditional in-class approach (Taradi et al., 2005). Dennis (2003) reported that Master of Physical Therapy students \( n = 17 \) in the USA who undertook online PBL spent significantly more time on-task than students \( n = 17 \) who undertook PBL in a face-to-face teaching environment. A German study found that medical students \( n = 74 \) who undertook blended PBL (combining face-to-face tutorials with online group discussions) reported significantly higher learning motivation, subjective learning gains, and satisfaction with their achievement in comparison with other students \( n = 71 \) who undertook traditional PBL (Woltering et al., 2009). These studies did not involve nursing students but their results strongly suggest that the use of online PBL to promote the learning of ADN students should be investigated.

In summary, PBL has been integrated into health education to improve students’ higher order thinking (Ozturk et al., 2008; Tseng Hui-Chen 曾惠珍 et al., 2006), and SDL (Kocaman et al., 2009; Lee, Lin et al., 2010). Although the literature indicates that PBL works as well in an e-learning environment as in a traditional face-to-face setting (Crawford, 2011; Dennis, 2003; Taradi et al., 2005), there are inconsistent findings in the literature about the effectiveness of traditional face-to-face PBL for improving students’ SDL in the health disciplines. This lack of consistency, the inconclusive findings, weaknesses in the research methodology of the studies, and the little research yielding empirical evidence that has been conducted in the nursing discipline indicate the usefulness of conducting the current study.

The effectiveness of online learning in promoting students’ information literacy will be examined in the following section.

2.3.3.3 Computer-assisted instruction in information literacy education

Computer-assisted instruction (CAI) and traditional face-to-face instruction have been found to be equally effective for enhancing students’ information literacy (Brettle &
Raynor, 2013; Salisbury & Ellis, 2003; Zhang et al., 2007). Beile and Boote (2004) reported that face-to-face instruction and a web-based tutorial were equally effective in promoting postgraduate education students’ (N = 49) library skills, but that the web-based tutorial significantly strengthened students’ self-efficacy level. The small sample size and the use of a questionnaire that had not been validated in Beile and Boote’s study suggests that their early promising results must be interpreted with caution. A later study found a similar, although non-statistically significant, difference between the results of using an online information literacy tutorial (n = 29) and a face-to-face session (n = 26) to convey the same material (information literacy skills) to pre-registration Diploma of Nursing students in the UK (Brettle & Raynor, 2013).

CAI that uses an online forum can encourage students’ reflection and critical thinking (Dunfee et al., 2008; Kenny, 2002). Higher order thinking is a fundamental skill for students’ information literacy development. Anderson and May (2010) reported that different teaching methods (online, n = 42; face-to-face, n = 45; and blended, n = 16) did not affect American undergraduate students’ information literacy scores, but their results are problematic as all the students had high information literacy knowledge scores (scored at 85%) before the instruction. Students in the online group had significantly higher scores for their persuasive presentation research assignments than those in the other groups. The assignments required the application of students’ higher order evaluation and synthesis skills. It was therefore assumed that these skills were promoted through the threaded online discussions with tutors and peers (Anderson & May, 2010). Anderson and May pointed out that their results should not be generalized without further research, and that it is necessary to integrate a broader teaching approach into information literacy education.

As mentioned above at section 2.3.1 Technology-enhanced learning, e-learning is an innovative method that closely matches the learning needs of the Net Generation and can augment learning. Johnston (2010) recommends online tutorials as a flexible, self-paced delivery module for students to develop information literacy skills. Traditional face-to-face instruction in information literacy, as with other topics, only has the limited allocated time available. In a study conducted in 2000, Holman found that a high percentage of American undergraduate students enrolled in English composition courses rated the pace of face-to-face instruction on bibliographies as too fast.
compared to the pace of an online tutorial (which the students could regulate). Mery et al. (2012) point out another limitation of a 50-minute face-to-face information literacy session: “It can only provide students with an introduction to basic library skills but cannot cover the more broad and complex tasks of seeking background information, identifying key terms, and the recursive exploration needed to complement the writing process” (p.369). It simply takes far more time and practice for students to become information literacy competent. The Ball State Nursing Program in the USA selected a web-based staff-librarian collaboration teaching module to avoid the limitations of face-to-face information literacy educational sessions. Subsequent evaluations found that students’ responses towards the module were positive (Dorner et al., 2001).

Various studies have found online information tutorials effective for supporting efforts to improve students’ information literacy (Anderson & May, 2010; Beile & Boote, 2004; Brette & Raynor, 2013; Grant & Brette, 2006; Johnston, 2010; Salisbury & Ellis, 2003; Wilhite, 2004), but few studies have employed nursing students as participants, particularly in Taiwan. A tutorial on OVID Medline was successfully integrated into a 12-week EBP module to improve the information skills of 13 nursing students in a master’s degree program (Grant & Brette, 2006). Their overall information skills improved and an increased number used advanced searching techniques. Specifically, the number of students using text-word searching and appropriately using the limit function tripled from two to seven (Grant & Brette, 2006). The sample size in this study was extremely small however, so caution must be exercised in trying to generalize the results.

In summary, the literature indicates that appropriate and effective ways to assist nursing students to develop information literacy skills have four crucial features. They:

1. are integrated into the curriculum;
2. involve interdisciplinary collaboration;
3. are learner-centred, as PBL is; and
4. use an e-learning package.

Assignments that link to content highly relevant to what students need and want to learn should be incorporated into the development of students’ information literacy skills. Another essential element is their capacity to be independent learners.
Knowles’ Adult Learning Theory is highly compatible with an approach to
information literacy education with these features. It assumes that a proactive,
collaborative, experiential and problem-oriented learning approach most benefits adult
learning. Nevertheless, educators have an important role to play in promoting students
learning. The next section discusses research focusing on how educators can best
prepare students to become self-directed learners.

2.4 How learners become self-directed learners

2.4.1 Matching learners’ needs with preparation for SDL

It is important to understand the need for student readiness to engage in SDL before
incorporating it as a component of a program. A good match between the teaching
delivery and SDL readiness of students in higher education offers the best opportunity
for improving students’ SDL (Grow, 1991). When there is a disparity between the
teaching style and the learning stages of learners, i.e., a lack of a “workable match”,
problems can arise.17 There is potential for student learning to be hindered by students
feeling overwhelming frustration and anxiety if they do not transfer smoothly from
pointed out “if SDL approaches are imposed contrary to students’ wishes then
annoyance and frustration may result, and teachers may be viewed as “not doing their
job” or abdicating their responsibilities” (p.366).

A basic principle behind Grow’s Staged Self-Directed Learning Model (1991) is that
“teaching is situational: the style of teaching needs to be matched to the learner's
ability and motivation at the time” (Mehay, 2010, p.1). Grow (1991) terms this ability
and motivation the learner's “readiness”.18 For this study’s investigation of effective
learning and self-directed learning, Grow’s “style of teaching” can be equated to
teaching strategies and approaches, and his individual learner's “readiness” can be

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17 The teacher's goal is to find a “workable match” (Grow, 1991, p. 129) between the students' learning
stage and the teacher's teaching style.
18 Grow’s (1991) model presents four stages of learners’ self-direction: Stage 1. being dependent;
Stage 2. being interested; Stage 3. being involved; and Stage 4. being self-directed.
equated to their initial capacity to undertake self-directed learning and, similarly, their motivation.

As mentioned at the beginning of this section, motivation can be enhanced by articulating to the learner the practical value of what is being learnt and what will be learnt in a course. Another model, Pratt's Model of Direction and Support (1988), presents SDL as influenced by learners’ having low dependency, by their commitment to the learning process, and by their confidence about and competency in the subject matter. This further indicates the importance of using appropriate teaching strategies and facilitation methods to establish, maintain, and improve students’ commitment to and confidence in the SDL processes. The next section discusses the role of teacher facilitation, a key element in supporting students’ SDL.

2.4.2 The importance of facilitation during SDL

Problem-based learning (Duman & Sen, 2012; Kocaman et al., 2009; Lee, Lin et al., 2010; Williams, 2004) and e-learning (Chen et al., 2009; Mitchell et al., 2007; Salyers, 2005; Thiele, 2003) have both been identified as useful teaching strategies to assist undergraduate students in the health disciplines to become more reflective and to develop self-directed learning abilities. Knowles et al. (2005) and Levett-Jones (2005) suggest that an important role for educators in adult learning environments is to help students arouse and maintain the motivation needed for SDL and, subsequently, to support them as they each engage in the process of becoming a self-directed learner.

Motivation for SDL

Having a session explaining the significance of SDL can help students to achieve a cognitive understanding of what it involves and, at the same time, to foster a commitment to SDL (Levett-Jones, 2005). This is congruent with Knowles’ assumption that adult learners “need to know why” before they engage in learning. Knowles et al. (2005) stress that adult learners need to know “how learning will be conducted, what learning will occur, and why learning is important” (p.184). A study in Norway of hospital personnel who received material about why cardio pulmonary resuscitation (CPR) was important to know and what they would learn found that they had a significantly higher level of motivation and valued the task more than personnel
who had not received this information (Hopstock, 2008): This finding supports the assumptions of both Levett-Jones and Knowles et al.

**Ongoing facilitation**

Various studies suggest that providing adequate facilitation is more likely to engage students and trigger their learning. Ongoing facilitation from teachers, for example by giving timely feedback, significantly influences students’ online learning satisfaction (Creedy et al., 2007) and engagement (Poellhuber, Chomienne, & Karsenti, 2008). Similarly, the SDL of students undertaking PBL can be enhanced by teachers’ facilitation (Barrows & Tamblyn, 1980; Woltering et al., 2009). Not all students are ready to engage actively in collaboration, but group dynamics and collaboration amongst group members can be promoted with the assistance of teaching staff (Baker, 2001; Wood, 2003) and a positive effect on students’ learning can be produced (Van Berkel & Dolmans, 2006). The next section outlines other factors associated with students’ SDL.

**2.4.3 Other factors influencing learners’ self-directed learning**

Apart from the important role played by facilitation, as discussed above, SDL is also influenced by individual differences such as age (Kocaman et al., 2009; Smedley, 2007; Yu-Hsiu Kao 高毓秀, Chu-Wei Yu 游竹薇, Shu-Yi Kuo 郭淑宜, & I-Hsiu Kuang 慶怡秀, 2013) and previous experience in SDL (Yuan et al., 2012). In regards to age, first year Australian nursing students aged 21 years and above had significantly higher SDL scores than students less than 21 years of age (Smedley, 2007). A study in Taiwan similarly found that the total SDL mean scores of Bachelor of Nursing students aged 20 or 21 years was significantly higher than those of students aged 18 or 19 years (Yu-Hsiu Kao 高毓秀 et al., 2013).

Regarding the part played by students’ previous experience with SDL, Yuan et al. (2012) found that Bachelor of Nursing students in the People’s Republic of China (PRC) who had previous experience in small group learning, SDL, or PBL had significantly higher levels of SDL than the students without such experience. On the other hand, newly hired nurses in a hospital in the USA were found to be poor self-
directed learners in a self-learning orientation nursing process program even though these nurses had previous working experiences (Carcich & Rafti, 2007). These studies both indicate that prior experience of learning independently further encourages students’ SDL.

Different teaching situations, strategies, and learning settings are other factors that appear to influence students’ SDL readiness. An online learning environment encourages students’ active learning and responsibility (Chen et al., 2009; Thiele, 2003). Thiele (2003) reported that online learning forced American undergraduate nursing students to engage more deeply with the learning content and that they became more independent. Similarly, Chen et al. (2009), who investigated Taiwanese post-registration nursing students, reported that the students’ online learning experience was “a transition of responsibility [which] consisted of a process from forming a positive view of a new learning approach, encountering adversity, overcoming difficulties, engaging in self-reflection to enjoying learning” (p.705). Their “transition of responsibility” can equally describe part of the process that occurs when students become familiar and comfortable with self-directed learning.

Clinical practice requires nurses to be able to be active and independent when acting in their roles of health givers. Clinical practice can effectively help enhance students’ SDL, at the very least by seeing role models in real workplace settings and experiencing the need to learn independent responsible thinking, which helps the critical motivation factor. Students can also observe the various constraints that require them to develop negotiation skills, including independent thinking. An Indian study (Devi, Devan, Soon, & Han, 2012) supports the importance of clinical engagement: The researchers reported that the SDL readiness scores of third year medical students undertaking a traditional curriculum ($n = 120$) were significantly greater than those of students who enrolled in another medical program which used a curriculum partially incorporating PBL ($n = 120$). Students in the traditional group were exposed to clinical practice from the second year of their course, but the PBL group was not exposed to clinical areas until their third year. The results suggest that the differences in the SDL scores of students in the different groups were associated with the different teaching strategies and learning settings. The results could be misleading, however, because of the lack of any baseline assessment data and the fact
that students were undertaking different programs.

The above studies indicate individual and situational factors that influence learners’ SDL. The following section discusses nursing students’ readiness for SDL.

2.4.4 Nursing students’ SDL readiness level

Five previous studies of Bachelor of Nursing students - in Australia ([N = 201] [Fisher et al., 2001] and [N = 66] [Smedley, 2007]); Turkey (N = 50) (Kocaman et al., 2009); Taiwan (N = 537) (Yu-Hsiu Kao 高毓秀 et al., 2013); and the PRC (N = 536) (Yuan et al., 2012) - all reported that their students had high levels of SDL readiness as measured using Fisher et al.’s (2001) SDLRSNE. Their average total SDLRSNE scores ranged from 150.6 to 154.7 and are all higher than the SDL cut-off standard of 150 proposed by Fisher et al. However, caution must be applied. These studies had relatively small sample sizes, and the tool may not be sufficiently discriminating in these populations.

Three studies have been undertaken investigating the SDL phenomenon among nursing students in Taiwan, although only Cheng et al.’s (2010) study focused on ADN students. However, the students’ SDL was measured using a researcher-developed questionnaire. That study reported that nursing students (N = 1,072) in Taiwan had moderate SDL levels (mean = 3.6, range between 1 and 5). The students in the study were undertaking one of three different nursing programs: the five-year ADN program (SD = 3.52), the four-year Bachelor of Nursing program (SD = 3.59), or the two-year Bachelor of Nursing program for registered nurses (SD = 3.7).19 The ADN students had the lowest SDL scores. The two-year Bachelor of Nursing program students had SDL scores that were higher than the scores of students in the other two programs, and the difference was statistically significant. The use of different questionnaires makes it difficult to compare their findings other than by using the descriptors of their scores. Cheng et al. (2010) developed a 20-item questionnaire to provide a measure of nursing students’ SDL in four domains: interpersonal

19 The two-year Bachelor of Nursing program in Taiwan provides a two-year nursing program for already registered nurses with an Associate Degree in Nursing to enable them to earn a Bachelor of Nursing degree. The Nurses Law allows people with an associate degree to obtain a nurse registration licence through a national examination.
communication, planning and implementation, learning motivation, and self-monitoring. The first domain, interpersonal communication, is not included in Fisher et al.’s (2001) SDLRSNE. This domain is less relevant to the concept of SDL.

Another study completed by Huang (2008) focused on final year undergraduate nursing students (N = 369) studying in the Technology and Vocational Education (TVE) sector. Their SDLNRNE mean scores (142.2) were not as high as those of the students in the 2013 Taiwanese study by Yu-Hsiu Kao 高毓秀 et al., nor of those in the other countries mentioned, but Huang (2008) reported that the distribution of the SDLRSNE scores was leaning towards the higher score end (150), and that on average the participants had a “strong desire for learning” and were “confident about self-management skills and self-control.” This strongly suggests that the participants were ready to engage in SDL.

With the exception of Cheng et al.’s (2010) study, all the above studies related to the SDL of students undertaking bachelor degree programs. This makes it difficult to compare the SDL readiness of Taiwanese nursing students undertaking an Associate Degree program with that of these other students in other parts of the world.

The results of the above studies are inconsistent with those from Saha’s (2006) study which found that the SDL readiness scores of Indonesian Diploma of Nursing students (n = 47 in intervention group, n = 54 in the control group), measured using Guglielmino’s Self-Directed Learning Readiness Scale (SDLRS) (1977),20 were below the average score for adults (mean = 190.7, SD = 18.6). Although the SDLRS scores of the intervention group increased significantly (from 190 to 203) after receiving a 12-week SDL module during their clinical practice, the scores remained below 214, the average for adults on that scale. Saha’s inconsistent finding may be a result of cultural differences, given that Indonesia is a conservative Muslim country where males dominate in society and nurses are predominantly female. In addition, in Indonesia the Diploma of Nursing program is considered to be at an inferior level

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20 Guglielmino’s SDLRS is also known as the Learning Preference Assessment (LPA). It is a self-report questionnaire with 58 5-point Likert-type items. Five levels (low, below average, average, above average, and high) of SDL were differentiated based on the total SDLRS scores of students which ranged from a low of 58 to a high of 290, with the average score for adults being 214 (Guglielmino, 1989).
compared to the Bachelor of Nursing program, and still used a teacher-led approach with little emphasis on incorporating any student-centred activities (Saha, 2006). Finally, as mentioned above in section 2.3.3.2, the construct validity of Guglielmino’s instrument has been questioned (Bonham, 1991; Field, 1989; Hoban et al., 2005), and some in fact have suggested discontinuing its use because of its problematic structure validity (Field, 1990). This instrument does, however, continue to be used, and this is a factor contributing to inconsistencies in the findings in the literature.

In summary, studies undertaken in countries outside Taiwan have produced somewhat inconsistent findings about the SDL readiness of nursing students. The differences may be caused in part by the use of different questionnaires, the diversity of students’ backgrounds, and their enrolment in a large range of programs based on a wide range of program designs. As discussed in Chapter 1, currently the major part of the clinical nursing workforce in Taiwan graduated from the five-year ADN program (Mei Chang & Yu-Mei Chao (Yu), 2008) and it is important to identify effective approaches for improving the SDL of students undertaking these courses. To do so requires reliable measurement of the students’ readiness for SDL, using a globally recognized validated scale. Measurement instruments and associated issues are discussed in detail in Chapter 4, Methodology.

2.5 Summary

Information literacy and SDL provide a basis for both lifelong learning and, more importantly for nurses, for EBP; thus, they are essential elements in educational programs of study. Previous studies suggest that many nurses lack adequate information literacy to support their practice in clinical settings. Studies report a variety of teaching foci and teaching modes being used to improve undergraduate students’ information literacy in a number of countries, but students need a teaching focus on the skills that enable them to locate information using academic databases.

Some studies reported a statistically significant increase in nursing students’ information literacy competency following education (Craig & Corrall, 2007; Grant & Brettle, 2006; Tarrant et al., 2008). Various assessment tools were used, some of
which had not been validated. Furthermore, limitations in the research design of some studies, such as the lack of a control group, a small sample size, and/or differences in the target groups, limit their generalizability.

The integration of e-learning is popular in the nursing discipline: An e-learning approach has been widely and successfully used in a variety of nursing programs and in many countries. Nevertheless, little empirical evidence could be found that e-learning is useful for improving nursing students’ information literacy. Furthermore, little research has focused on addressing the web-enhanced learning, SDL, and information literacy education of ADN students in Taiwan. The current study aims to evaluate the effectiveness of an intervention to improve ADN students’ SDL and information literacy, in particular their online searching knowledge, skills, and self-efficacy, and thereby provide empirical evidence, making a useful contribution to the understanding of this important aspect of student learning and to students’ future practice.

The literature suggests that a web-enhanced educational intervention would be useful for assisting students by promoting their online searching knowledge, skills, and confidence. Such an intervention would take into account the literature indications that the effectiveness of e-learning is influenced by the principles and theories underpinning it, as well as, and possibly more than, the computer technology itself. Studies on the use of web-enhanced education strategies to promote SDL, PBL, and information literacy strongly support the use of PBL for integrating SDL skills.

The design of the intervention can be informed by Knowles’ Adult Learning Theory with its emphasis on learner-centred, problem-oriented, and collaborative learning, all compatible with and related to SDL. The intervention incorporates both a PBL approach, as supported by the literature, and the completion of an assignment which requires the students to conduct authentic information searches using databases. A mixed methods approach was also incorporated in order to gain more insight into the students’ experience of the e-learning process.

E-learning that is learner-centred and self-directed learning has many features in common with the concepts of Knowles’ Adult Learning Theory’s “adult learning” but
this theory has been challenged. The next chapter presents the theory in detail, discusses the challenges, and gives the rationale for selecting KALT as the appropriate theoretical framework to guide the current study.
Chapter 3: Theoretical framework

This chapter describes the theoretical framework of the current research. The appropriateness of using Knowles’ Adult Learning Theory (KALT) to inform nursing educational research will be justified. Further, a conceptual framework of the current research is presented after a critical review of Knowles’ works.

A critical review of KALT will be presented that justifies the appropriateness of the use of Knowles’ work in informing nurse educational research.

3.1 Knowles’ Adult Learning Theory

In the early 1970s, Malcolm Knowles posited a theory of adult learning called Andragogy, Knowles’ Adult Learning Theory (Sherow, 2006). “Andragogy”, originating from the Greek word aner which means “man”, was used to illustrate the art and science of helping adults learn (Knowles, 1975). The characteristics of adult learners, described by Knowles (1970) as self-directed and intrinsically motivated, stemmed from humanistic psychology with its focus on human growth and self-actualisation (Engler, 2009).

Humanism background

Humanism is a school of thought that focuses on human freedom, dignity, and potential (Learning Theories Knowledgebase, 2010). Humanistic theorists emphasize the view of the person as an active, creative, experiencing human being who lives in the present and responds subjectively to current perceptions, relationships, and encounters. Moreover, they stress that the human personality is a positive and optimistic one that enhances the tendency of humans towards growth and self-actualisation (Engler, 2009).

The goal of humanistic education is ultimately the “self-actualisation of a person, the becoming fully human, the development of the fullest height that the human species can stand up to or that the particular individual can come to” (Maslow, 1971).
Humanists state each individual learner has the potential for growth and that effective function can result in learning. For example, motivation, choice, and life tasks of individuals will influence their learning; therefore, Humanists reject the Behaviourists’ view that environmental factors determine learning (Sherow, 2006). It was argued by Maslow (1971) that Behaviourism provided an inadequate explanation of human learning. He argued that human life is more than simply external reinforcement (Abrahm-Maslow COM, 2009): That is, Humanists assume that individuals will develop as the individual desires when appropriate conditions are provided (Cloninger, 1996).

**Assumptions of Knowles’ Adult Learning Theory**

The assumptions about the characteristics of adult learners proposed by Knowles expanded from four to six as a result of continuing research and theory (Knowles et al., 2005). These assumptions are (that for adult learners): their self-concept shows a move toward self-direction; their learning is based on prior experiences; their readiness to learn is enhanced when they experience a need to cope with a life situation; their learning orientation is life-centred; their need is to know why before they engage in learning; finally, their learning is motivated by an internal rather than an external payoff (Knowles, 1990). These assumptions indicate that self-directed learning occurs when learners have a specific need to know something in order to be more effective in some area of their life (Shepard, 2009). As a result, adult learning will be optimal when a learning environment is provided based on these assumptions. Such a learning environment includes using group discussions, providing problem-solving information, and respecting students’ autonomy, mechanisms that are similar to those used in the implementation of problem-based learning (PBL) as previously mentioned in Chapter 2, the literature review chapter.
Table 1. Knowles’ assumptions about adult learners

<table>
<thead>
<tr>
<th>Learners’ Characteristics</th>
<th>Knowles’ Assumptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. The need to know.</td>
<td>Adult learners “need to know” why, what and how before they engage in learning.</td>
</tr>
<tr>
<td>2. The learner’s self-concept</td>
<td>Adults have a self-concept of being responsible for their own decisions, for their own lives.</td>
</tr>
<tr>
<td>3. The role of experience.</td>
<td>Adult learners have a greater volume and a different quality of experience from that of children.</td>
</tr>
<tr>
<td>4. Readiness to learn.</td>
<td>Adults are ready to learn when they need to manage their life situation.</td>
</tr>
<tr>
<td>5. Orientation to learn.</td>
<td>Adults prefer a problem-solving orientation to learning and learn best when new information is presented in a real-life context. Adults are life-centred in their orientation to learning.</td>
</tr>
<tr>
<td>6. Motivation.</td>
<td>Adult learners are more responsive to internal rather than external payoff.</td>
</tr>
</tbody>
</table>

Note: Resources cited from Knowles (1990).

**Educator’s role in adult learning**

A learner-centred teaching method, such as PBL, emphasizes that the role of educators of adults is to facilitate learning instead of transferring information and skills (Knowles, 1975). For adult learners, the aim is to create a learning environment conducive to their learning (Knowles et al., 2005). Hence, when educators consider how to augment their students’ learning, instructional design should include the preparation for learners to learn ‘how to learn’. As described in Knowles’ andragogy in practice model, this process model is different from the content model employed by most traditional educators. The significant difference between the two models is that the former focuses on providing procedures and resources for helping learners to acquire information and skills (Knowles et al., 2005). Knowles and colleagues (2005) also proposed some implications for adult education, including the need to: provide a learning climate that prepared learners to be self-directed and change the role of the educator from an instructor to a facilitator (student-centred). Furthermore, the use of teaching strategies should emphasize the rich resources of learners such as group discussion, the case method, seminars, and demonstrations. It is better arranging group homogenous learners together and use real-life concerns of learners to meet the characteristic of readiness to learn; and, finally, use a problem-orientation to design learning curricula which satisfy students’ immediacy of application of learning (Knowles, 1970).
**Application in health-related disciplines**

The work of Knowles continues to be applied widely in a range of disciplines, including adult education in the workplace (Holyoke, 2007), nutrition (Ramsay, Holyoke, Branen, & Fletcher, 2012; Wright et al., 2012), medicine (Stahl & Davis, 2009) and nursing education (McKenna et al., 2011; Oupra, Griffiths, Pryor, & Mott, 2010). The belief that the learning environment underpinned by KALT facilitates the development of learners as more active, engaged, competent, autonomous, and responsible continues to be supported (Davis & Schrader, 2009; Gabbert & Sims, 2007; Textor & Porock, 2006; Ward & McCormack, 2000).

KALT has become popular within nursing education because it is founded on a humanistic philosophical stance and is informed by the assumption that adults are self-directed learners. Self-directed learning is an important capability for nursing graduates in this information and technology proliferative age (Kocaman et al., 2009). Most importantly, KALT is a humanistic educational process that values the individual: The relationship between educator and student is respectful and caring (Milligan, 1997), which is akin to the core values of nursing. Knowles’ principles, as shown in Table 1, provide a teaching approach in which educators act as facilitators and prepare appropriate education environments to augment learning. These environments include the essential components of self-directed learning, experiential learning, problem-centeredness, information applied learning, and learning stimulated by intrinsic motivation (Knowles et al., 2005). These are well-matched to the implementation of university and clinical nursing education strategies such as PBL and simulated learning (Karner et al., 2012; Yaeger & Arafeh, 2008).

**3.2 Criticism of Knowles' Adult Learning Theory**

Knowles’ Adult Learning Theory (KALT) stimulated debate within the adult education field since the 1970s and 80s (Elias, 1979; Hartree, 1984; Rachal, 2002; Tennant, 1986). The focus of this debate has been the underlying assumptions of the theory, principally, the use of andragogy to describe the learning of adults and to draw a distinction with the teaching of children (pedagogy) because of the different
perspectives about the self-concept of adults and children as learners (Darbyshire, 1993; Hartree, 1984; Tennant, 1986).

The common use of “andragogy” differentiates adult education from “pedagogy”, children’s education, giving rise to the debate whether adults and children can be categorised as dichotomous in the context of learning. However, the dichotomous learning between adults and children is a misunderstanding of Knowles’ approach. According to Knowles and colleagues (2005), this model is used to differentiate between the assumptions about learners that have traditionally been made by those who practise pedagogy in contrast to the assumptions made in andragogy. In the context of learning, the term “adult” refers to those who are self-directed in their learning regardless of the age of learners (Knowles, 1975). Knowles (1975) highlighted the difference between the two terms - child and adult - based on the set of assumptions about learners, rather than the age of learners. Teachers will teach andragogically whether teaching children or adults if they adopt the assumption that independency is the nature of human maturation (Knowles et al., 2005). In other words, andragogy is a term used to refer more broadly to teaching and learning for any age group, which is student-centred and which fosters learner autonomy (McAllister, Lincoln, McLeod, & Maloney, 1997). This statement is reinforced by the incorporation of the principles of Knowles’ theory into the current K-12 education system21 in the USA to develop leadership for social justice of students (Brown, 2004).

Moreover, nursing students cannot independently learn if they lack previous experiences of professional knowledge and skills upon which to draw. Benner (1982) used the Dreyfus Model to explain that there are five phases for nurses to become expert while acquiring skills in clinical practice. Benner (2004) found that the knowledge, skills, competency, and independency of nurses progressed when they accumulated sufficient practices or experiences. Also, Pratt (1988) described self-directedness as a situational attribute and the product of a specific person-situation interaction. These examples indicate that adult learners are self-directed when they accumulate sufficient related experiences.

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21 K–12 is a short expression of kindergarten (K) through twelfth grade (12) of free education in the USA and Canada. It is a designation for the sum of primary and secondary education.
Another criticism about Knowles’ assumptions originates from the lack of empirical evidence of their effectiveness (Wilson, 2005). Over three decades, Rachal (2002) challenged the empirical literature examining the efficacy of andragogy as being inconclusive and beset by considerable variability in definition, resulting in differing approaches to andragogy’s implementation. However, an in-depth review of andragogy reveals that Knowles’ intentions were to put learners first, to strive to help them meet their needs, and to encourage educators constantly to be available to guide learners to success (Blondy, 2007). Based on personal, practical adult teaching experiences in Ireland, McGrath (2009) explained that if adult learners are aware of the reason they are learning new skills and the benefits of learning their interest and motivation will be enhanced, they will demonstrate their ‘readiness’ to learn, and they will be more willing to participate in discussions in the classroom or learning context. In addition, KALT is supported by Houde (2006), using two motivation theories to strengthen the validation of these assumptions: for example, not knowing why learning something is important is associated with a state of low or no motivation. Self-determination theory may be used to describe the relationship between motivations (knowing why) and understanding the consequences of an action (engagement) in learning. Therefore, KALT is supported by some adult educators, notwithstanding that Knowles’ assumptions may not be formulated on empirical research but are developed as a result of experience, observations, and theoretical influences (Blondy, 2007; McGrath, 2009).

The use of Knowles’ assumptions about adults is a starting point and a touchstone of good practice for the foreseeable future for educators who might wish to turn away from an instrumental approach toward a more humanistic understanding of their learners (Ralf, 2002). This notion is supported by that fact that the work of Knowles remains widely applied in a range of disciplines and levels of education (Meeker & Byers, 2003; Stagnaro-Green, 2004; Stahl & Davis, 2009; Weinstein, 2004).

Adult learning is the term used to describe activities that aim to encourage learners to develop their lifelong and self-directed learning attitudes (Knowles, 1970). This notion is supported by a pedagogy reform occurrence (teaching philosophy change) in medical education that integrates the principles of adult learning into the curriculum.
It is assumed that students gain more learning benefits through learner-centred or self-directed learning than content-focused or teacher-led learning (Kaufman, 2003; Stagnaro-Green, 2004; Stahl & Davis, 2009). As Stahl and Davis (2009) questioned “What good is exposure to content if it is not remembered? What is the value of a presenter who designs lectures that are easy and interesting for the lecturer but fail to convince a participant to use the information?” (p.181) Similarly, Stagnaro-Green (2004) states that medical education has been a realization that the informal curriculum, the environment that a student learns in, along with the countless daily interactions, impacts greatly on the efficacy and outcome of the learning process. This statement indicates the significance of the self-directed learning ability of students. Thus, educators are encouraged to use Knowles’ principles as guidelines for teaching learners who tend to be somewhat independent and self-directed (Kaufman, 2003).

In summary, KALT is popular in health-related disciplines because it is believed that a learner-centred approach will augment students’ learning. However, the assumptions of Knowles’ theory have been challenged due to inconclusive and insufficient empirical evidence (Rachal, 2002). Therefore, the next section presents a critical review using empirical nursing educational research to support the role and usefulness of KALT in informing the current research.

3.3 A critical review of the use of Knowles’ assumptions in guiding nursing education

This section justifies the appropriateness of using KALT to inform the current research through a critical review of research in nursing education. Searching strategies, the critical review, and the implications for nursing education and research are discussed. Finally, a conceptual framework for the current research is described.
3.3.1 Method/Searching strategy

Relevant articles were retrieved from a range of electronic databases, including CINAHL, Medline, ERIC, SCOPUS and PsycINFO. A set of MeSH keywords included: adult learning, self-directed learning, lifelong learning, continuing education, and Knowles. Additional literature was retrieved from the reference lists of retrieved articles. Inclusion criteria included:

- Primary research articles;
- Articles published between 2000 and 2012;
- Research studies guided by KALT; and
- Articles with a nursing educational focus – may include patients or others.

Each article was critically reviewed using the Critical Appraisal Skills Programme (CASP)\textsuperscript{22} tool as suggested by Aveyard (2010). Three broad questions suggested by the CASP tool were considered when appraising the literature after an evaluation of the study methods. The questions included: What are the results? Are the results of the study valid? Will the results be helpful locally?

The initial search involved reviewing the abstracts of the retrieved 338 articles. Of those 338 articles, 223 were excluded as not meeting the search inclusion criteria. Thus, 115 potential studies were identified to be included in the review. After reviewing the full articles, 30 were found to fulfil the inclusion criteria. The majority were rejected because they presented opinions of experts, outlined intervention development that was not empirically tested, or were not related to the nursing discipline.

3.1.1.1 Overview

These 30 studies were conducted mainly in Western countries, as shown in Table 2 (see page 62), including 15 studies in the USA (Andrighetti et al., 2012; Carcich &

\textsuperscript{22}This set of tools has been developed by the CASP at the Public Health Research Unit at University of Oxford, available at \url{http://www.casp-uk.net/find-appraise-act/appraising-the-evidence/}. The CASP tools ask questions about the research methods used in a paper which is different from other appraisal tools available. They are generic to all types of literature. Aveyard (2010) suggests that questions in a design-specific appraisal tool will prompt the researcher to ask the most relevant questions of the paper.
Rafti, 2007; Davis & Schrader, 2009; Elisha, 2008; Elliott et al., 2001; Feingold et al., 2004; Frommelt, 2003; Gabbert & Sims, 2007; Hessig et al., 2004; Lamiani & Furey, 2009; Mollon et al., 2012; Naik, Teal, Rodriguez, & Haidet, 2011; Schneiderman et al., 2009; Sedlak, Doheny, & Jones, 2000; Textor & Porock, 2006), three in each of the UK (Bahn, 2007; Norrie & Dalby, 2007; Ward & McCormack, 2000) and Canada (May, Day, & Warren, 2006; Mayer et al., 2005; Noel-Weiss, Rupp, Cragg, Bassett, & Woodend, 2006), two in Australia (Manias & Aitken, 2003; Mitchell & Courtney, 2005), and one study in each of the following countries: Ghana (Bansah, O’Brien, & Oware-Gyekye, 2009), Italy (Trento, Passera, Borgo, Tomalino, & et al., 2004), Japan (Inoue, Del Fabbro, & Mitchell, 2012), New Zealand (McKenna et al., 2011), Norway (Hopstock, 2008), Sweden (Bengtsson & Ohlsson, 2010), and Thailand (Oupra et al., 2010). This indicates that KALT has been internationally accepted as a theoretical framework for nursing educational research.

In Table 2, the versatility of KALT has also been demonstrated in studies addressing a variety of educational levels and learning settings, including formal school education, continuing education in the workplace, patient education, technology-enhanced learning such as e-learning (Carcich & Rafti, 2007; Gabbert & Sims, 2007; Mollon et al., 2012; Schneiderman et al., 2009), and simulated learning (Andrighetti et al., 2012; Feingold et al., 2004; McKenna et al., 2011).

Twenty-one of the 30 articles used an experimental design to test the effects of an intervention guided by the principles of Knowles. However, nine studies used only a one-group before and after test design to identify the effects of the teaching (Elisha, 2008; Feingold et al., 2004; Lamiani & Furey, 2009; Mayer et al., 2005; McKenna et al., 2011; Mollon et al., 2012; Schneiderman et al., 2009; Sedlak et al., 2000; Textor & Porock, 2006). A further three studies employed a control group in their research design; however, there were fewer than 30 participants in each group, inadequate for statistical power and open to an increased probability of a Type II error (Andrighetti et al., 2012; Carcich & Rafti, 2007; Hessig et al., 2004). The methodological weaknesses are presented in Table 2.
<table>
<thead>
<tr>
<th>Study (country/year)</th>
<th>Aims of study</th>
<th>Research design</th>
<th>Sample</th>
<th>Results</th>
<th>Critique/notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andrichetti et al. USA/2012&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>To determine whether a high-fidelity simulated scenario informed by KALT could effectively improve students’ confidences in managing shoulder dystocia and postpartum hemorrhage complications.</td>
<td>A quasi-experimental design</td>
<td>20 midwifery students Control group (n=10) Intervention group (n=18)</td>
<td>Students’ confidences in managing shoulder dystocia and postpartum hemorrhage complications significantly increased.</td>
<td>Small sample size</td>
</tr>
<tr>
<td>Inoue et al. Japan/2012&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To identify the continuing educational needs of nurses in a Japanese adolescent mental health unit.</td>
<td>Qualitative study Focus groups</td>
<td>14 registered mental health nurses from two focus groups</td>
<td>Nurses’ need for knowledge in fundamental areas related to their everyday work.</td>
<td>Generalization is limited; Small sample size</td>
</tr>
<tr>
<td>Mollon et al. USA/2012&lt;sup&gt;b,d&lt;/sup&gt;</td>
<td>To examine the effect of an online, evidence-based practice educational intervention on clinical staff’s practice, attitudes, and knowledge/skills related to evidence-based practice (EBP).</td>
<td>A pre- and post-test design</td>
<td>282 nurses completed the pre/post survey</td>
<td>Staff’s practice, attitudes, and knowledge/skills related to EBP did not significantly improve.</td>
<td>Lack of a control group</td>
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<td>McKenna et al. New Zealand/2011&lt;sup&gt;b,d&lt;/sup&gt;</td>
<td>To test the effectiveness of a simulated program in helping nurses’ competencies to give a second opinion at a court hearing.</td>
<td>A mixed methods design</td>
<td>112 mental health nurses 66 nurses completed one-year follow-up</td>
<td>Nurses’ competencies to give a second opinion at a court hearing significantly improved and maintained at one-year follow-up.</td>
<td>Lack of a control group</td>
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<tr>
<td>Naik et al. USA/2011&lt;sup&gt;c&lt;/sup&gt;</td>
<td>To compare the effectiveness of two methods in diabetic patients.</td>
<td>A randomized trial</td>
<td>84 diabetic patients Intervention group (n=44) Control group (n=41)</td>
<td>The intervention group showed significantly greater knowledge.</td>
<td>Non-validated questionnaires used</td>
</tr>
<tr>
<td>Bengtsson and Ohlsson Sweden/2011&lt;sup&gt;a&lt;/sup&gt;</td>
<td>To explore information regarding what students consider important for their motivation to attain knowledge.</td>
<td>A qualitative design</td>
<td>31 undergraduate nursing (n=16) and medical (n=15) students from five focus group discussions</td>
<td>The findings supported KALT that adult learning is intrinsic, motivated, and responsible.</td>
<td>Generalization is limited due to the use of a small qualitative study</td>
</tr>
<tr>
<td>Oupra et al. Thailand/2010&lt;sup&gt;e&lt;/sup&gt;</td>
<td>To test the effectiveness of a nurse-led Supportive Educatative Learning program for family caregivers of stroke survivors in Thailand on caregivers’ quality of life and their strain levels.</td>
<td>Two-group non-randomized study</td>
<td>137 caregivers of stroke patients in two groups Intervention group (n=70) Control group (n=67)</td>
<td>Caregivers in the intervention group had significantly better quality of life and lower strain levels.</td>
<td>Number in sample is small; Recruited participants from one research site</td>
</tr>
<tr>
<td>Study</td>
<td>Objective</td>
<td>Methodology</td>
<td>N</td>
<td>Findings</td>
<td>Limitations</td>
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<td>Bansah et al. Ghana/2009&lt;sup&gt;c&lt;/sup&gt;</td>
<td>To explore the learning needs of multigravid women in Ghana.</td>
<td>A qualitative study</td>
<td>18 women from individual interview (n=8) and a focus group discussion (n=10)</td>
<td>The results revealed that the learning needs of adult women are life-related and centre on problem-solving information.</td>
<td>Generalization of the findings is limited given the use of a qualitative survey</td>
</tr>
<tr>
<td>Davis and Schrader USA/2009&lt;sup&gt;a&lt;/sup&gt;</td>
<td>To compare syllabi expectations between 27 faculty and 199 bachelor of nursing students.</td>
<td>A survey</td>
<td>226 participants included 27 faculty and 199 students</td>
<td>There were different syllabi expectations between the faculty and students. The students saw the faculty both as a resource and co-learners. The assumptions of KALT are supported using adult BN students’ comments.</td>
<td>Survey used needed additional validity and reliability testing; Limited sample size; Recruited from only one research site</td>
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<tr>
<td>Lamiani and Furey USA/2009&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To evaluate the effectiveness of a patient education workshop on nurses’ communication skills, knowledge of a patient-centred model and patient education process, and sense of preparedness to provide patient education.</td>
<td>One group pre-test and post-test design</td>
<td>14 nurses</td>
<td>After the workshop, the nurses showed a significant improvement in these capabilities.</td>
<td>Lack of a control group; Small sample size</td>
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<td>Schneiderman et al. USA/2009&lt;sup&gt;b,d&lt;/sup&gt;</td>
<td>To determine the effectiveness of a computer-based learning module specific to arterial blood gas (ABGs) interpretation.</td>
<td>One group pre-test and post-test design</td>
<td>58 staff nurses from two community hospitals</td>
<td>Nurses’ post-test knowledge scores significantly increased.</td>
<td>Lack of a control group; Non-validated test was used; A larger sample size is required</td>
</tr>
<tr>
<td>Elisha USA/2008&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To determine the effectiveness of an eight-hour continuing education course on the Certified Registered Nurses Anesthetist Clinical Educators’ (CRNACEs) perceived behaviour change and knowledge.</td>
<td>A exploratory survey</td>
<td>33 CRNACEs</td>
<td>The participants’ perceived behaviour change and knowledge significantly increased.</td>
<td>Small sample size used; Non-validated questionnaire used</td>
</tr>
<tr>
<td>Hopstock Norway/2008&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To investigate whether hospital personnel are motivated to participate in a cardiopulmonary resuscitation (CPR)</td>
<td>A survey</td>
<td>361 hospital personnel (including nurses, physicians, and)</td>
<td>Respondents who had been prepared for the course, who had participated in the decision about attending the course, who</td>
<td>Non-validated questionnaire used; Generalization</td>
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<tr>
<td>Study</td>
<td>Design</td>
<td>Participants</td>
<td>Setting</td>
<td>Findings</td>
<td>Limitations</td>
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<td>Bahn</td>
<td>UK/2007</td>
<td>To explore nurses’ orientation toward formal (continuing education and higher education) and informal (recreational) learning.</td>
<td>A qualitative study</td>
<td>20 nurses in the UK</td>
<td>The nurses who took part in continuing education were intrinsically motivated. Also, the participants felt that higher education contributed to enhanced client care, reporting additional personal and professional satisfaction. Generalization of the findings might be limited due to the small sample and qualitative approach.</td>
</tr>
<tr>
<td>Carcich and Rafti</td>
<td>USA/2007</td>
<td>To compare the effectiveness of self-learning modules (SLMs) and a traditional lecture/discussion method on experienced registered nurses’ learning satisfaction during the hospital nursing orientation process.</td>
<td>Two groups, post-test only design</td>
<td>20 experienced nurses (Control group (n=10) Intervention group (n=10))</td>
<td>The control group of nurses had higher satisfaction levels; thus, rejecting Knowles’ assumption that adults are self-directed learners. Used only post-test design; Sample size was small (10 in each group)</td>
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<tr>
<td>Gabbert and Sims</td>
<td>USA/2007</td>
<td>To investigate current nursing students’ perceptions of teacher-student interactions in their online nursing courses which were developed based on humanistic theories.</td>
<td>A survey</td>
<td>227 nursing students enrolled in four nursing programs representing both urban and rural geographic areas</td>
<td>Students’ perceptions of the staff-student interaction in online learning courses were described as supportive and caring. The supportive and caring perceptions are related to learners’ age and prior experiences. Convenience sampling; Used only one research site</td>
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<tr>
<td>Norrie and Dalby</td>
<td>UK/2007</td>
<td>To explore whether the characteristics of adult learners move away from highly structured teaching methods (pedagogic teaching) to more explorative and less formal ones (andragogic teaching).</td>
<td>A survey</td>
<td>318 nursing students from three different year levels</td>
<td>The first year students had significantly the highest mean scores in two questions amongst the three year level groups. An inappropriate research design was used; Non-validated questionnaire used</td>
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<tr>
<td>Authors</td>
<td>Title</td>
<td>Methodology</td>
<td>Sample Size</td>
<td>Findings</td>
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<tr>
<td>May et al.</td>
<td>To explore patients’ experiences through a spinal cord injury rehabilitation educational program.</td>
<td>A qualitative study using semi-structured interview</td>
<td>22 spinal cord injury patients</td>
<td>Patients believed their learning would be enhanced through the incorporation of adult learning principles into educational programs.</td>
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<tr>
<td>Canada/2006c</td>
<td>To determine the effects of a prenatal breastfeeding workshop on maternal breastfeeding self-efficacy (BSE) and breastfeeding duration.</td>
<td>A randomized controlled trial (RCT) design</td>
<td>92 primiparous women were randomized into two groups Control group (n=45) Intervention group (n=47)</td>
<td>The mean BSE scores of the participants in the intervention group were significantly higher than those in the control group. Number in sample is small; Recruited participants from one/same research site</td>
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<tr>
<td>Noel-Weiss et al.</td>
<td>To determine the effectiveness of a pain education intervention guided by Knowles’ Adult Learning Theory in nurses’ pain management knowledge.</td>
<td>A one-group pre-test and multiple post-test design</td>
<td>46 nurses in a rural Midwest retirement community; 46 completed the pre-test and immediately the post-test; 35 also completed the second post-test four weeks after the intervention</td>
<td>The nurses’ first and second post-test pain management knowledge scores were significantly higher that their pre-test scores. One group pre-test and multiple post-test design</td>
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<tr>
<td>Textor and Porock USA/2006b</td>
<td>To determine the effectiveness of a pain education intervention guided by Knowles’ Adult Learning Theory in nurses’ pain management knowledge.</td>
<td>A one-group pre-test and multiple post-test design</td>
<td>46 nurses in a rural Midwest retirement community; 46 completed the pre-test and immediately the post-test; 35 also completed the second post-test four weeks after the intervention</td>
<td>The nurses’ first and second post-test pain management knowledge scores were significantly higher that their pre-test scores. One group pre-test and multiple post-test design</td>
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<tr>
<td>Mayer et al.</td>
<td>To evaluate the effectiveness of a self-directed learning manual program in staff nurses’ self-efficacy for health promotion counselling of patients at risk of stroke.</td>
<td>A time serial, one group quasi-experimental design study</td>
<td>23 RN staff in a neuroscience unit</td>
<td>Self-efficacy levels of the participants both in their knowledge and counselling significantly increased between prior to (time 1) and immediately after the intervention (time 2). The increase in knowledge and self-efficacy remained at two months after the intervention. Lack of a control group; Small sample size</td>
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<tr>
<td>Mitchell and Courtney</td>
<td>To describe the development, implementation and evaluation of a transfer brochure for family members of patients in an intensive care unit (ICU) to improve patient transfer to a general ward.</td>
<td>A quasi-experimental design</td>
<td>162 family members of patients in ICU divided into two groups Intervention group (n=82) Control group (n=80)</td>
<td>Participants in the intervention group showed significantly higher levels of satisfaction with the information given to them before transfer from ICU (p=0.01), higher levels of understanding of the information (p=.002), and more preparedness for the transfer (p&lt;.0001) Only conducted at one study site; Small convenience sample used in developing the brochure might not be representative</td>
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<tr>
<td>Authors</td>
<td>Title</td>
<td>Methodology</td>
<td>Participants</td>
<td>Findings</td>
<td>Limitations</td>
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<tr>
<td>Feingold et al.</td>
<td>To evaluate perceptions of nursing students through the use of a computerized patient model in a simulated clinical scenario.</td>
<td>A cross sectional study design</td>
<td>97 bachelor nursing students</td>
<td>The majority of the participants agreed the simulations were realistic and valuable. More than 80% of the students agreed this approach was helpful to their clinical skills test and decision-making.</td>
<td>Non-validated questionnaire; Small sample from one research site; A descriptive survey only.</td>
</tr>
<tr>
<td>Hessig et al.</td>
<td>To evaluate the effects of an eight-hour educational program addressing the 10 selected complementary therapies on oncology nurses’ attitude, perceived knowledge, and self-reported application of these therapies.</td>
<td>A quasi-experimental questionnaire with a pre-and post-test design</td>
<td>44 RNs working in two hematology and oncology patient care units within a large tertiary care medical center. Intervention group (n=11). Control group (n=33)</td>
<td>The intervention was useful in enhancing knowledge (regarding relaxation, spirituality, and touch) and, to some degree, increasing the application of some of the therapies such as imagery and massage.</td>
<td>A self-developed non-validated questionnaire used; Small sample used.</td>
</tr>
<tr>
<td>Trento et al.</td>
<td>To compare the effectiveness of two different self-management approaches on type 2 diabetes patients’ knowledge, problem-solving ability, and quality of life over time.</td>
<td>A five-year randomized controlled study</td>
<td>112 people with type 2 diabetes randomly allocated into two equal size groups of 56</td>
<td>Participants’ knowledge, problem-solving ability, and quality of life in the intervention group increased across the years but those of the control group worsened.</td>
<td>Number of sample is small; Recruited participants from one/same research site.</td>
</tr>
<tr>
<td>Frommelt</td>
<td>To examine the effects of an educational program on attitudes toward caring for terminally ill persons and their families.</td>
<td>A quasi-experimental designed study</td>
<td>115 undergraduate students including nursing, psychology, and physical therapy were divided into two groups Intervention group (n=49). Control group (n=65)</td>
<td>A significant change in attitude was found in the experimental group but not in the control group.</td>
<td>Participants self-selected to join the intervention.</td>
</tr>
<tr>
<td>Manias and Aitken</td>
<td>To describe the development, implementation, and evaluation of a new critical care curriculum based on the tenets of collaborative workplace learning.</td>
<td>A survey</td>
<td>200 bachelor of nursing students enrolled in one critical care course from two different year cohorts who experienced differently designed curricula Intervention group (n=104)</td>
<td>The intervention group showed greater satisfaction with their education and had a higher self-reported percentage in their clinical practice and critical thinking skills.</td>
<td>Used two groups of students enrolled in different years without controlling the differences existing in the pre-test between the two</td>
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<td>Reference</td>
<td>Study Title</td>
<td>Methodology</td>
<td>Participants</td>
<td>Findings</td>
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<tr>
<td>Elliott et al. USA/2001&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To identify the effectiveness of a rural cancer care project at Lake Superior.</td>
<td>A group-randomized, controlled trial design</td>
<td>521 community health practitioners including physicians, nurses, and pharmacists were randomly grouped into three: Group 1 (n=216); Group 2 (n=154); Group 3 (n=151)</td>
<td>At the post-test the intervention group showed a significant knowledge increase over the control group. Non-validated questionnaire used; Generalization of the findings is limited due to using samples from only one regional community</td>
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<tr>
<td>Sedlak et al. USA/2001&lt;sup&gt;c&lt;/sup&gt;</td>
<td>To evaluate the effectiveness of three osteoporosis education programs on women’s knowledge, health belief, and preventive behaviour.</td>
<td>One group pre-test and post-test design</td>
<td>84 women divided into three groups: Intense group (n=31); Intermediate group (n=35); Brief group (n=18)</td>
<td>Participants in all groups significantly improved their knowledge after the education programs; but, little change in their health beliefs and behaviour. Small sample size; Lack of a control group</td>
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<tr>
<td>Ward and McCormack UK/2000&lt;sup&gt;b&lt;/sup&gt;</td>
<td>To present an account of a practice development strategy that aimed to create a learning culture as a sub-element of the overall program of work.</td>
<td>An action research</td>
<td>Four nursing development project leaders in a hospital</td>
<td>A positive patient care outcome had been derived from audits of standards of nursing care and practice. The value of a humanistic learning approach is grounded in the eventual benefits the organization achieves in the long term. These include a flexible workforce, improved communications, and clear problem solving strategies; all key components of current approaches to life-long learning strategies and the development of learning cultures. Generalization is limited due to small sample size and qualitative approach</td>
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Note: The application of KALT is versatility; a refers to formal education; b refers to continuing education in workplace; c refers to patient education; d refers to technology-enhanced learning, including simulated learning and e-learning.
3.1.1.2 Critical Review

Four themes emerged from the analysis of these 30 studies and are presented as follows:

1. Nursing professionals are assumed to be active and responsible for their learning in terms of being self-directed.

2. Experiential learning grounded in past personal and professional experience enhances learning in the nursing discipline.

3. Problem-oriented learning opportunities empower nurses in making informed clinical practice decisions.

4. Life-related learning opportunities inform nurses on how to support patients and families in managing health-related challenges.

Self-directing learning in nursing education

The assumption that adults are self-directed learners reflects the expectation that nurses have a professional responsibility to maintain and update their knowledge, skills, and abilities to deliver safe and competent care (Schneiderman et al., 2009). Based on this assumption, in Canada, Mayer et al. (2005) used a self-directed learning manual based on Bandera’s Self-Efficacy Theory and KALT to improve 23 neuroscience nurses’ self-efficacy in providing health promotion counselling to patients at risk of having a cerebral haemorrhage. After completion of the SDL manual, there was a statistically significant increase in participants’ self-efficacy both in knowledge and counselling. Similarly, the study by Schneiderman et al. (2009), which used a web-based learning module to teach community hospital nurses how to interpret arterial blood gas analysis, resulted in a statistically significant increase in nurses’ knowledge scores. The findings of these two studies (Mayer et al., 2005; Schneiderman et al., 2009) confirm the view that nurses are self-directed learners; thus, Knowles’ assumption that adults are self-directed learners is supported.

The claim that nurses and students are self-directed learners has been challenged by three studies in this critical review; however, they all have methodological limitations (Carcich & Rafti, 2007; Mollon et al., 2012; Norrie & Dalby, 2007). Mollon et al. (2012) used an online learning module to improve American nurses’ attitudes, knowledge, and skills in evidence-based practice (EBP). After a two-month period of
self-paced learning, these nurses did not show a statistically significant improvement in these abilities. The module focused on knowledge about EBP rather than independent learning abilities. Similarly, Carcich and Rafti (2007) compared the effectiveness of two methods of delivering a hospital nursing orientation program to newly hired nurses with clinical experiences. This study showed that those participants who received only a self-learning module (SLM) had lower levels of satisfaction - associated with not being treated like adult learners - compared to those nurses who received a lecture and small group discussions. This finding supports the argument that successful SDL is reliant upon mutual respectful, collaborative, and supportive learner-facilitator interaction (Knowles, 1975; Knowles et al., 2005). Similarly, Norrie and Dalby (2007) questioned Knowles’ assumption about a continuum of learners’ self-directed capacities development. However, the researchers inappropriately compared the SDL of students from three different year level groups. A single cohort study design would be more credible (Kocaman et al., 2009). In short, the evidence is not convincing in refuting the value of SDL in nursing education based on these methodologically flawed studies.

Lifelong learning is an important nurse characteristic needed to improve practice and to bridge the well-documented theory-practice gap (ANMAC, 2006; Mayer et al., 2005). Bahn (2007) argues that nurses’ lifelong learning is triggered by enjoyable prior learning experiences. The learner-centredness of KALT in nursing education assists in providing meaningful, enjoyable learning. A learner-centred approach encourages learners to take control of their learning which results in higher learner self-esteem and satisfaction (Davis & Schrader, 2009; Gabbert & Sims, 2007).

Nursing students prefer to learn within a humanistic environment (Davis & Schrader, 2009; Gabbert & Sims, 2007). Davis and Schrader (2009) argue that self-directed adult learners tend to see themselves in partnership with educators and view their teachers as learning resources. Similarly, Gabbert and Sims (2007), in exploring e-learning experiences of nursing students in the USA, found that Watson's Human Caring Theory and KALT successfully informed teacher-student online interactions in the curriculum. Students in this study perceived the online interactions as supportive and caring. These two studies confirm the values of KALT, grounded in humanism, in guiding learner-directed nursing education.
Experiential learning in nursing education
Simulated learning has been used effectively by drawing upon nurses’ personal and professional past experiences. Nurses’ clinical competencies are based on experience accumulation. Thus, experiential learning approaches have been widely applied in nursing. As Benner (2004) has argued, the accumulation of experience in clinical settings forms the foundation for nurses developing from novices to experts.

Nursing educators aim to provide a range of opportunities to support novice students to gain experience and further learning through practice (Andrighetti et al., 2012). However, over the past four decades in selected countries, a shift from hospital-based programs to university settings has been argued to have had a negative impact on the wealth of student clinical practicum experiences (Feingold et al., 2004). Andrighetti et al. (2012) argued that this reduction in clinical experience affects students’ abilities to practise, impairing their development of nursing skills and decision-making abilities. Patient simulated technology with a high level of realism has been implemented as compensation (Feingold et al., 2004). A number of studies informed by KALT have examined the place of simulation (Andrighetti et al., 2012; Feingold et al., 2004), role-play (Frommelt, 2003; McKenna et al., 2011) and hands-on exercises (Hessig et al., 2004) in supporting nurses’ and students’ learning.

Simulated learning environment based on KALT has been used effectively to increase nursing competencies. Two studies in the USA used simulated scenarios to strengthen nursing students’ clinical and decision-making skills (Andrighetti et al., 2012; Feingold et al., 2004). After the simulated learning, these undergraduate students’ clinical and decision-making skills had improved: hence supporting the worth of KALT being incorporated into simulated learning situation in nurse education.

Empirical evidence has further reinforced Knowles’ assumption that adult learning is a transfer/transformation of prior experience (Frommelt, 2003; Hessig et al., 2004; Lamian & Furey, 2009; McKenna et al., 2011). Role-play, hands-on exercises, and group discussions are common teaching strategies to support this transformation. Two studies have demonstrated the effectiveness of employing a role-play model: the first, to improve American undergraduate nursing students’ attitudes towards the care of the terminally ill (Frommelt, 2003); the second, to improve New Zealand nurses’
confidence to give a second opinion at a court hearing (McKenna et al., 2011). Similarly, one American study completed by Lamiani and Furey (2009) employed both role play and group discussions successfully to improve nurses’ communications skills, their knowledge of the patient-centred model, and their sense of preparedness to provide patient education.

The use of group discussions supports Knowles’ (1990) notion that learners’ experiences are resources for their learning. Another three studies in the USA demonstrated that effectiveness: in improving the pain management knowledge of nurses practising in a rural retirement community (Textor & Porock, 2006); in supporting rural cancer care professionals’ knowledge about cancer practice (Elliott et al., 2001); in the perceived behaviours and knowledge improvement of Certified Registered Nurses Anaesthetist Clinical Educators (Elisha, 2008). Hessing et al. (2004) successfully integrated KALT with King’s Goal Attainment Theory to inform the development of an educational intervention that offered hands-on exercises and successfully improved oncology nurses’ attitudes, perceived knowledge, and self-reported application of 10 complementary therapies. All of these studies confirm that the foundation of adult education is learning by doing: therefore, adult learning based on experience is supported.

**Problem-oriented learning in nursing education**

In order to fulfil the role of care-giver, nurses are required to demonstrate their problem-solving (Mayer et al., 2005), communication abilities (Lamiani & Furey, 2009), and mastery of nursing skills (Hopstock, 2008). These demands motivate nurses to empower themselves to manage problem-solving challenges encountered in daily clinical settings (Inoue et al., 2012).

KALT has been used successfully to guide nurses’ continuing education (Hopstock, 2008; Inoue et al., 2012; Mayer et al., 2005; Textor & Porock, 2006). In a number of studies, the nurses were clearly motivated to learn by their need to master aspects of their role: pain management in a rural retirement community (Textor & Porock, 2006); counselling training for neuroscience nurses (Mayer et al. 2005); mental health nursing knowledge and skills (Inoue et al. 2012); the use of cardio pulmonary resuscitation (CPR) by Intensive Care Unit (ICU) and Emergency Room nurses
(Hopstock, 2008); providing relevant information for families in ICU (Mitchell & Courtney, 2005); and educating family caregivers of stroke survivors (Oupra et al., 2010). The findings of these studies support the assumption by Knowles that problem-oriented learning is crucial in supporting nurses to make informed clinical decisions when managing challenging aspects of their practice roles.

**Nursing education needs to be relevant to the recipient**

Nurses are required to provide information in supporting patients and their families to cope with health-related challenges that is relevant to them. KALT-informed research studies have demonstrated their usefulness in guiding patient education; patients and their family caregivers are reported to be more satisfied with knowledge that informs their health management and supports the attainment of life quality improvements (Mitchell & Courtney, 2005; Oupra et al., 2010; Trento et al., 2004). However, when the given information does not meet perceived needs, anxiety increased (Bansah et al., 2009).

Bansah et al. (2009) explored the learning needs of 18 multigravid Ghanaian women and reported that participants experienced increasing certainty and reduced anxiety when they received health information that was consistent and meet their needs. Similarly, a long term (five-year) self-management educational program for diabetic patients increased their quality of life as it was structured to meet their needs (Trento et al., 2004). In agreement, Oupra et al. (2010) reported an improved quality of life and a reduction in perceived strain for families of stroke survivors following hands-on stroke care education designed to meet their needs. Mitchell and Courtney (2005) found that when a family-focused brochure-based education was specific to the individual, they reported greater satisfaction than traditional ICU transfer education for families of ICU patients. All these studies confirm the usefulness of KALT in guiding individualised relevant patient education research.

In summary, the value of KALT in guiding nursing education is reinforced by this critical literature review. Specifically, there are four areas in the nurse education literature that support the use of KALT: nursing professionals are expected to be self-directed learners, their learning is a transformation based on prior experience, and their learning is problem-oriented and is relevant to the recipient’s life situation. This
theory is useful in shaping and informing formal nursing education and nursing continuing education, and may also support nurses in making informed clinical decisions and in educating patients. KALT is also versatile in that it can be applied in both on-campus and e-learning settings. Thus, using KALT to guide nursing education research is credible. A recommendation for future research is to examine KALT in nursing education outside of the American context.

3.3.2 Implications for nursing education and research

KALT is appropriate to guide e-learning as self-directed and information literate nursing graduates are required to support informed patient safety and effective health care (Penz & Bassendowski, 2006; Shorten et al., 2001). In order to facilitate self-regulation of learners, e-learning has been integrated into curricula in tertiary education (Richardson & Newby, 2006). This approach also advantages students in learning information technology (IT) skills which empower them to access and locate important and appropriate information thereby enabling information literacy development, a prerequisite for evidence-based practice (Shorten et al., 2001). The overarching reason to use SDL in nursing education is that it embodies the principles of adult learning (Nagle, McHale, Alexander, & French, 2009).

This literature review confirms the usefulness of KALT in the nursing discipline as the nature of nursing education relies heavily on the prior experience of learners, seeking life-oriented, problem-oriented, and life-related information. It assumes that learners are responsible for their learning and are self-directed. This theory has been internationally accepted as a guide to nursing education research. As a result, the assumptions by Knowles (1990) and the principles of Problem-Based Learning (Barrows & Tamblyn, 1980) were used to inform the current research, and the development of the intervention. However, this critical review revealed a number of gaps in our evidence in relation to adult learning in students from non-Caucasian backgrounds which are not English speaking countries with western culture and future research should address this gap in our knowledge.
3.4 Conceptual framework of the current research

The conceptual framework is adapted from andragogy in practice model proposed by Knowles and colleague (2005), shown as rings in Figure 3, and explains how the six core adult learning principles of adults will be influenced by individual and situational differences and the goals and purpose for student learning. These core principles include:

1. adult learners “need to know” why, what and how before they engage in learning.
2. adults have a “self-concept” of being responsible for their own decisions, for their own lives.
3. the “learners prior experience” will be a resource for learning and serves as a mental model which act as a filter to learning through an attentional process
4. adults are “ready to learn” when they need to manage their life situation
5. adults prefer a problem solving orientation to learning and learn best when new information is presented in a real-life context; they are life-centred in their “orientation to learning”, and
6. adults learners are more “motivated by internal need satisfaction” than external payoffs. (Knowles, 1990).

Goals and purpose for learning, the outer ring of the model, shows the developmental outcomes. Three dimensions of learning goals/purpose are included: individual growth, institutional growth, and societal growth. The implementation of evidence-based nursing practice has become a trend over the world, including the USA (McCulley & Jones, 2014), Finland (Koivunen et al., 2010), and Taiwan (Mu Pei-Fan穆佩芬, Tsay Shwu-Feng 蔡淑鳳, & Chang Li-Yin 張麗銀, 2013). The trend urges the need for nursing professionals to be information literate and lifelong learner (Courey et al., 2006; Skiba, 2005). Nurses are responsible for updating their nursing knowledge and skills to ensure patient safety and quality of care. This is also true in Taiwan (Huang Chin-Yi 黃靜宜, Huang Su-Tsai 黃素猜, Lee Yea-Wen 李雅文, Liao Yi-Cheng 廖以誠, & Chang Shu-Chen 張淑真, 2006). The current research goals and purposes for the individuals (learners) and the institution (Nursing Department at Meiho University in Taiwan) are to cultivate in nursing students/graduates adequate
knowledge, skills, and self-efficacy in conducting information searches using library databases for clinical practice and academic writing. Furthermore, preparing students to be self-directed and lifelong learners has become one of the essential goals for nursing schools in the current information technology age.

Individual and situational differences, the middle ring of this process learning model, are impacting variables that act as filters and shape the practice of learning. This indicates that differences in learning subject matter, individuals’ prior experiences and learning style preferences, and educational approaches and settings used—can impact on the core adult learning principles. Based on this model, the current research provided a teaching approach in which educators act as facilitators and prepare appropriate education environments to augment learning. These environments should include the essential components of self-directed learning, experiential learning, problem-centeredness, information applied learning, and learning stimulated by intrinsic motivation (Knowles et al., 2005).
Figure 3. Theoretical framework.
Chapter 4: Methodology

This chapter describes the research design, setting, sample, outcome measures, the study intervention, data collection, analysis plan, and ethical considerations. For clarity the research questions are restated:

1. What was the level of the ‘online search knowledge’ of the control group and the experimental group before and after the intervention period?
2. What was the level of the ‘online search skills’ of the control group and the experimental group before and after the intervention period?
3. What was the level of the ‘online search self-efficacy’ of the control group and the experimental group before and after the intervention period?
4. What was the level of the self-directed learning readiness of the control group and the experimental group before and after the intervention period?
5. What was the effect of an educational intervention on the online search knowledge, skills, self-efficacy, and self-directed learning readiness of Associate Degree in Nursing (ADN) students in the intervention cohort compared to ADN students who received usual instruction?

The review of the literature established that there are significant gaps in the web-enhanced learning among nursing students. Firstly, even though studies have addressed nursing students’ learning using web-enhanced modes, there is very little evidence establishing the effectiveness of web-enhanced learning in ADN students in Taiwan (Chen Shu-Wen 陳淑雯, Chiu Shu-Ching 邱淑卿, Shiah Dah-Ming 夏大明, & Chung Yueh-Chin 鍾月琴, 2005). Secondly, previous studies addressing the effectiveness of web-enhanced learning in nursing students had methodological weaknesses associated with statistical conclusions, construct, and internal validity (Buckley, 2003; Salyers, 2005, 2007; Smith, 2002). Therefore, the effectiveness of web-enhanced education in nursing students has not been established to date (Buckley, 2003; Salyers, 2005, 2007).
The current study tested the effectiveness of web-enhanced education addressing online searching of nursing information for ADN students in Taiwan using a rigorous research design.

4.1 Design

The following section addresses the research design including method, research variables for the quantitative approach, research questions for the qualitative component of the research and, finally, research procedure.

Method

The aim of this research was to determine whether participants who receive a web-enhanced education addressing online searching of academic databases have greater knowledge, enhanced skills, higher self-efficacy, and more readiness in relation to self-directed learning than students who receive the usual face-to-face instruction. A mixed methods design was employed with questionnaires and focus groups. Cluster randomization was used as individual randomization was not possible - participants were within one of six classes and instruction occurred on a class basis. Cluster randomization has the advantage of reducing the likelihood of contamination between the intervention and control group members and ensured a feasible and effective method of manipulation of the education participants experienced (Polit & Beck, 2012). However, Polit and Beck (2012) states that this also results in the difficulty to detect a significant result. Pre-test post-test measures and focus groups were conducted. A mixed methods design was adopted as it was judged to be feasible and would provide a comprehensive understanding of the research phenomena (Cohen & Manion, 1994; Creswell & Plano Clark, 2011; Creswell., 2009; Holloway & Wheeler, 2010; Trochim, 1999).

The combination of both qualitative and quantitative approaches increases the research strength in several aspects (Creswell., 2009; Greene, 2007; Johnson & Onwuegbuzie, 2004; Tashakkori & Teddlie, 2003; Teddlie & Tashakkori, 2009). First of all, the understanding of the research questions/concepts can be deepened through the combination of methods from different epistemological traditions (Foss &
Ellefsen, 2002). Also, the research results are more meaningful and complete than those from a singular method approach (Annells & Whitehead, 2007). For example, in this current research, the quantitative data demonstrated whether the knowledge scores of the participants increased or not; at the same time, comments from the participants in focus group discussions provided insights into what aspects of their knowledge changed after the intervention and explained how they gained the knowledge (Johnson & Onwuegbuzie, 2004). Furthermore, research rigour is improved with the use of a mixed methods design (Foss & Ellefsen, 2002; Jones & Bugge, 2006). The same research question was examined through different approaches and the results were able to be mutually examined.

**Research variables for the quantitative approach**

The research variables in this current research consisted of one independent variable and four dependent variables derived from the research questions. The web-enhanced online searching skills educational programme was the independent variable. The selection of the four dependent variables was based on Knowles’ assumption about adult learners and the literature review. Details related to measuring these variables are provided later in the Method section of this chapter.

**Research questions for the qualitative component of the research**

Focus group discussions were also used to explore the level of the ADN students’ online searching knowledge, skills, self-efficacy, and self-directed learning readiness before and after the intervention period. This method provides meaningful and supplementary information in answering the research questions using the participants’ own words (Creswell & Plano Clark, 2011). Focus groups were adopted for several reasons:

- First, a group discussion is a more natural or social method for participants when expressing their experiences compared to one-to-one interviews. As a result, more information is elicited when the participants feel more relaxed and comfortable.
- Second, the focus group discussions served as a source of follow-up data to supplement the primary quantitative data with open-ended information (Morgan, 1997). The mix of both quantitative and qualitative data provides a
more complete picture of the research problem than either the quantitative or qualitative data sets alone (Creswell & Plano Clark, 2011; Holloway & Wheeler, 2010).

- Third, the use of focus groups is an efficient data collection method compared to individual interviews. Each focus group was formed because participants shared the common learning experience that was of interest to the researcher.
- Finally, focus groups provide an effective feedback mechanism for discussions to evaluate the effectiveness or impact of a curriculum (Keven & Webb, 2001; Litosseliti, 2003; Tashakkori & Teddie, 2003) which was the focus for the current research.

Four specific questions based on the research questions were used as cues to facilitate the focus group discussions both before and after the intervention period (Holloway & Wheeler, 2010; Sarantakos, 2005). The questions were:

1. How would you describe your knowledge of searching online (via academic databases)?
2. How would you describe your capability/skills to retrieve information online (via academic databases)?
3. How would you describe your confidence level in doing online searches (via academic databases)?
4. To what degree do you think of yourself as an independent learner?

**Research procedure**

The overall research design and schedule for data collection are shown in Figure 4. This design presents a mixed methods experimental design with focus groups discussions and questionnaires. Qualitative data collections occurred following both the pre-test and post-test surveys.

This research was within a pre-set student course which contained a traditional face-to-face teaching session on evidence searching (given by a librarian) in a computer laboratory. There were also some additional practical activities. A structured group assignment was used for all students to master their searching skills. This component of students’ subject learning was not altered for the research and is referred to
throughout as ‘usual instruction’. Additional detail regarding usual instruction is found in Section 4.5.

Before the intervention, the pre-test focus group discussions were used to gain insights into the learning needs of the participants. The researcher developed a package of self-paced online learning materials based on the learning needs of the participants. After the intervention, the post-test focus group discussions were used as a cross-validity check and to corroborate findings in the current research (Creswell, 2009; Holloway & Wheeler, 2010).

The research methodology included three phases:

- Phase I - recruiting participants, group allocation (based on one class as a unit), collecting of baseline information of participants using questionnaires and the pre-test focus groups, and the refinement of materials for the intervention program.
- Phase II - intervention stage.
- Phase III - outcome measurement using questionnaires, and focus group discussions.
Assessed for eligibility (N = 292 students)

Excluded (n = 38 students): Not meeting inclusion criteria (n = 12); refuse to participate (n = 26).

Cluster randomization (n = 4 classes)

Control group (n = 87 students) Completed pre-test questionnaires
Usual instruction
Lost to follow-up (n = 14 students)
Analyzed (n = 73 students) Completed post-test
Post-test focus group interview (n = 2 groups)

Experimental group (n = 83 students) Completed pre-test questionnaires
Usual instruction + a web-enhanced approach
Lost to follow-up (n = 12 students)
Analyzed (n = 69 students) Completed post-test
Post-test focus group interview (n = 2 groups)

Figure 4. Study Design and Data Collection Procedure
4.2 Setting

This current research took place at Meiho University, which is located in Pingtung County, Taiwan. Meiho University was established in 1966. Initially, there was only the Nursing Department with about 300 students in a five-year Associate Degree in Nursing Program. Currently, there are 17 departments, including the Department of Nursing, and three graduate institutes in this university. There are over 8,000 students enrolled in a variety of programs; of this total, approximately 1,500 are ADN students.

The ADN Program at Meiho University is mainly campus-based and the majority of the ADN students are female in the age range 16 to 20 years. Characteristics of ADN students at Meiho University are similar to other Taiwanese ADN students in their educational background, age, and gender (Yeh Chang Mei 張媚 & Chao Yu Yu-Mei 余玉媚, 2010). Students need to have completed three years of junior high school to gain entry into the Program. Following completion of this degree, graduates will find employment in a hospital or clinical setting. Also, they will get a professional title as registered nurses if they successfully pass the National Registered Nurses Examination in Taiwan.

Language used in data collection
Chinese was used in all data collection, including questionnaires and focus group discussions, because it is the official language in Taiwan. The researcher is Taiwanese, with English as her second language.

Two questionnaires, originally written in English, were translated into Chinese using the forward-translation and back-translation procedure, and verifying procedures (Brislin, 1970; Flaherty et al., 1988). More details will be described in section 4.4.3.

With regard to the focus group discussions, all transcripts were first written in Chinese and then translated into English. The researcher transcribed all the recordings verbatim and then analysed the transcripts written in Chinese. The quotations used in the Results Chapter were translated into English using the forward- and back-translation process as previously described. The researcher translated the quotations
from Chinese to English then another bilingual Doctoral-prepared nurse academic translated the English back to Chinese. The integrity of the translations was established with the use of a bilingual academic colleague not associated with the research (Yu, Lee, & Woo, 2004).

4.3 Sample

This section describes sampling for the current research. The definitions of the experimental group and control group will be introduced, followed by inclusion and exclusion criteria for participants. The following outlines recruitment strategies as well as sample size.

Inclusion criteria:
1. enrolled fourth year ADN students;
2. enrolled in the Course “Case Study Discussion in Nursing;”
3. able to read, speak, and write Chinese.

Fourth year students were the focus as up to this point in their education, they had not been expected to have mastered the skills of accessing and evaluating nursing information from online sources. In their final year, however, the students are expected to be able to demonstrate ability to access appropriate online resources which are assessed via a written assessment. Accordingly, this provided a unique opportunity to test an innovative mode of providing online educational materials which was well matched to the theoretical framework used in the research (Knowles et al., 2005).

The characteristics of the students in accordance with the framework included:
1. They were a group of similarly aged young adults;
2. They were currently enrolled in the Course “Case Study Discussion in Nursing” in which students are required to search information when completing an academic assignment. For example, the participants used a real community patient as a case for discussion then proposed a nursing plan using
information retrieval from databases; thus the educational focus was highly relevant to them;

3. They had previous learning and group work experiences; they had completed some theory subjects, such as Fundamental Nursing Theory and Technique, Medical-Surgical Nursing, Paediatric Nursing, and Gynaecological Nursing, Nursing Ethics, and Patient Education;

4. They were going to undertake off campus clinical practice, which required students to apply online searching skills in locating information to solve clinical practice problems and to complete their assignments.

**Recruitment of participants**

There were 1,566 ADN students enrolled in the five-year program with 292 within the fourth year of the program. Several strategies were used to invite participants. For example, one lecturer from the Nursing Department at the research site acknowledged and communicated this study to potential participants followed by a courtesy face-to-face invitation from the researcher to these potential participants. The researcher explained the benefits of participation to the individuals and to nursing education through the ADN program. For the convenience of participants, the completion of questionnaires and focus group discussions were conducted on campus. Furthermore, a small gift was given in recognition of each participant’s time (a McDonald’s meal voucher). Informed consent was obtained before any data were collection.

**Sample size**

1. **Questionnaire**

A total sample size of 136 participants was calculated to provide sufficient statistical power, with 68 ADN students in each group. The sample size was calculated based on previous studies by Monoi, O’Hanlon and Diaz (2005) and of Smedley (2007). The study of Monoi et al. (2005) examined the online searching skills self-efficacy of undergraduate students using the Online Searching Self-efficacy Inventory (OSSI) as the primary outcome measurement. The results of that study’s mean score of OSSI was 5.97±1.86 in the pre-test, and 8.54±1.26 in the post-test was used in the calculation. In addition, the study by Smedley (2007) utilized the SDLRSNE by Fisher, King, and Tague (2001) to measure the level of self-directed learning readiness of first year Bachelor of Nursing students. Those results showed that the
sum of the SDLRSNE in the subgroup aged under 19 years was 144.37±12.86 and in another age subgroup (≥19) was 153.14±18.31. Based on the two previous studies, the current research aimed for a moderate effect size of 50% (Cohen, 1998). To provide a power of 80% using an α of .05, at least 52 participants were required in each group. To account for potential attrition in this project that was to continue over a period of ten weeks, an additional 30% was added to the sample size. Thus, a further 32 were added to the 104 making the final sample 136 participants.

Based on the figures, recruiting 136 participants was therefore feasible. However, as cluster randomization was being used, and each class ranged from 43 to 58 students, four classes were anticipated to be adequate to achieve the required sample size.

2. Focus groups
Focus group discussions were employed once before the intervention and once after the intervention for both the control and the experimental groups. Prior to the intervention, two pre-test focus groups for each group were formed to collect data concerning the online searching background of the participants and their learning needs for the specific skills. After the intervention period, two post-test focus groups for each group were formed to explore the changes that the participants described in their online searching knowledge, skills, self-efficacy, and their readiness for self-directed leaning.

A purposive sampling technique was used to recruit the samples for the focus group discussions from the class clusters. The interviews were used to capture the learning experiences of the participants regarding their online searches (Rabiee, 2004). Participants from the same class participated in the same focus group discussion due to the principles of homogeneity that influence the interactions within the group who were very familiar with each other as they studies together for all their courses (Llewellyn, Sullivan, & Minichiello, 2004; McLafferty, 2004; Robinson, 1999).

The inclusion criterion for the pre-test focus group discussions included the requirement to have completed the pre-test questionnaires. The post-test focus group discussions applied the same principles and inclusion criterion, with the additional criterion that participants were required to complete the post-test questionnaires in
order to be included. Each focus group had between 6 to 12 participants as this number range is considered to be manageable while sufficient to gain a variety of perspectives (Holloway & Wheeler, 2010; Morgan, 1997). The researcher decided to over recruit participants by 10 to 25% to allow for non-attendance (Rabiee, 2004). Consequently the sample size for focus group attendance was set at 12 for each group.

**Group allocation**
Eligible participants were drawn from the 292 ADN students who were already grouped for their program in one of six classes. Importantly, these nursing students were randomly allocated into the six classes, according to their registration number before the commencement of their program. The researcher used one class as a unit and recruited participants from four of the six classes. Each cluster (i.e. class) was randomly drawn, using a box containing six pieces of papers with the class names A, B, C, D, E, and F nominating a respective class. The first four classes randomly drawn were allocated into either the control or the experimental group.

After ethical approval by the Institutional Review Board (IRB) of Meiho University and Griffith University Human Research Ethics Committee (Appendix 1), an academic colleague spoke to potential participants in their classrooms and distributed flyers on behalf of the researcher. The flyer included information regarding the current research, what would be required if they agreed to participate and responsibilities of the researcher. Contact details of the researcher and an invitation to make contact - if they had any question for the current research study- were included (Appendix 2). Ethical considerations are discussed later in this chapter.

### 4.4 Description of questionnaire

This section describes the five questionnaires used in the pre- and post-test periods.

These questionnaires consisted of:

1. a set of demographic and background questions,
2. Online Searching Knowledge Test (OSKT),
3. Online Searching Skills Test (OSST),

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4. Online Searching Skills Inventory (OSSI) (Monoi et al., 2005), and
5. the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) (Fisher et al., 2001).

Permission to use the OSSI and SDLRSNE were obtained from the authors (Appendix 3). Detail relating to the questionnaires used in the research is presented in the section and a copy of the survey can be seen in Appendix 4.

4.4.1 Section1: Demographic and background items

The set of demographic and background items included questions relating to the participants’ age and gender, prior web-enhanced and database learning experience, and a 10-item questionnaire, with each item scored on a 5-point scale (ranging between 1 and 5). These items were derived from the literature and were developed by the researcher. They aimed to measure participants’ previous online learning experience as well as their computer and internet competency, and to elicit details about information resources they currently used for conducting searches. The previous online learning experience of the participant was measured by items 1 and 2; the internet and computer proficiency was measured by items 3 to 5; and information resources used by the participants were measured by items 6 to 10. Table 3 presents examples from the 10 background items.

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Items included</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Previous online learning experience</td>
<td>1-2</td>
<td>Item 2: I use materials in the web-enhanced learning platform for my study.</td>
</tr>
<tr>
<td>2</td>
<td>Existing computer and the internet competency</td>
<td>3-5</td>
<td>Item 4: My computer skills cover my learning needs.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Item 5: My Internet skills cover my learning needs.</td>
</tr>
<tr>
<td>3</td>
<td>Information resources used</td>
<td>6-10</td>
<td>Item 7: I use search engines such as Google and Yahoo to locate information when I need to.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Item 9: I use academic databases such as Airti Library or CINAHL to search information when I need to.</td>
</tr>
</tbody>
</table>
4.4.2 Section2: Tests used in the study

Two researcher-developed knowledge and skills tests were used to measure the online searching knowledge and skills of the ADN students in Taiwan as no tool was available in the literature. Prior to the two Tests being employed in the current research, their face and content validity was assessed as outlined below. The following section sequentially describes in more detail the two Tests.

4.4.2.1 Online Searching Knowledge Test

This Online Searching Knowledge Test (OSKT) was developed by the researcher based on personal experiences, opinions from experts, and specific literature in this area (American Library Association, 2000; Beile & Boote, 2004; Craig & Corrall, 2007; Monoi et al., 2005). The OSKT was developed as a multidimensional test based on the information literacy competency standards for higher education for the cohort in this study.

Information literacy competency standards have been divided into five standards and each standard has multiple performance indicators and outcomes (American Library Association, 2000). It was not necessary to demonstrate the reliability of this test since it was developed for multiple choice of question of a quiz instead of a questionnaire. In fact, reliability of a Likert-scale is used to show the consistency of one’s attitude towards a specific area such as level of satisfactions and confidence. The validation process undertaken included validity of the dichotomous knowledge assessment tool was established through face validity and content validity (Mooi & Sarstedt, 2011). Also, extreme item difficulty value and suggestions of experts were used as an item analysis technique for the development of the test (Polit & Beck, 2012).

Initially, the researcher developed 20 multiple choices questions with the aim of measuring participants’ online searching knowledge. To assess face validity that the questions measured what they were intended to measure, the researcher had four nursing educators and two librarians who had experience in teaching online searching skills at nursing schools in Taiwan assess the questions for their appropriateness.
In regards to content validity, three nursing educators, who were experienced in teaching online searching with the ADN students, were asked to evaluate individual items and to rate the relevant of each item. Then the content validity index (CVI) was calculated. This index is used to assess the quality of each item that is relevant and appropriate in terms of the construct (Polit & Beck, 2012). The experts in this study rated items on a 4-point scale of relevance: 4=highly relevant, 3=quite relevant, 2=somewhat relevant but needs minor changes and 1=not relevant - needs major changes. The item CVI (I-CVI) was computed as the number of experts giving a rating of either three (quite relevant) or four (highly relevant), divided by the total number of experts - that is, the proportion in agreement about the relevance of each item (Polit & Beck, 2012). The scale-level CVIs (S-CVIs) were calculated by the average of the I-CVIs amongst the total items. As shown in Table 4, the I-CVI ranged between .67 (moderate agreement) and 1.00 (complete agreement), which is considered to be acceptable. Importantly, an S-CVI value of .89 was computed, which almost reached an excellent content validity standard of .9 as suggested by Polit and Beck (2006).

Table 4. I-CVI of the Online Searching Knowledge Test

<table>
<thead>
<tr>
<th>Item description</th>
<th>Educator</th>
<th>Item CVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which database would you use to search and download a nursing journal article with full text? A. CEPS B. Taiwan Journal Articles Image system C. Electronic Thesis &amp; Dissertations System.</td>
<td>A 4  B 4  C 2</td>
<td>.67</td>
</tr>
<tr>
<td>2. Which approach is best for you in searching information concerning the statistics for the birth rate of newborns in Taiwan? A. Yahoo engine B. Electronic Thesis &amp; Dissertations System C. the website of Department of Health, Executive Yuan, Taiwan.</td>
<td>A 4  B 4  C 4</td>
<td>1.00</td>
</tr>
<tr>
<td>4. Your professor has assigned a review of the literature for your paper. Which of the following would be the best source to start with? A. Magazine B. Newspaper C. Internet search form library, such as Airiti Library or CINAL.</td>
<td>A 4  B 4  C 4</td>
<td>1.00</td>
</tr>
<tr>
<td>5. Which is not a synonym for or related to “leukaemia” in terms of your information searching? A. Cancer B. Oncology C. Chemotherapy.</td>
<td>A 3  B 4  C 1</td>
<td>.56</td>
</tr>
<tr>
<td>6. Which set below is best for you to locate information directly about the side effects of chemotherapy experienced by leukaemia patients? A. (leukaemia OR chemotherapy) B. (leukaemia AND chemotherapy) C. (leukaemia AND symptom).</td>
<td>A 4  B 4  C 1</td>
<td>1.00</td>
</tr>
<tr>
<td>7. Which sentence below does not underline the main concepts (keywords)</td>
<td>A 4  B 4  C 3</td>
<td>.91</td>
</tr>
</tbody>
</table>
of the title?  A. How to assist participants coping with the change in their body image after a colostomy surgery  B. The self-care behaviour of diabetic patients  C. The exploration of non-compliant behaviour of patients with hypertension.

8. Which set below best represents the main concepts in the following sentence “how to assist the mother to cope with the loss and grief concerning the death of their child due to brain cancer”?  A. Cancer and grief  B. Loss and coping  C. Death and coping.

9. Which set below best represents the main concepts in the following sentence “What are the health risks to women athletes who use anabolic steroids”?  A. Women, females, drugs  B. Women athletes, health risks, steroids  C. Drugs, athletes, performance.


11. What is the truncation symbol used in Taiwan Journal Articles Image system to locate variants of search words, such as “teach,” “teacher,” and “teaching”?  A. !  B. *  C. #.

12. What is truncation?  A. Searches for variant endings to a word  B. Means that two words have to occur beside each other  C. Searches for any word in a search statement.

13. In the following three options, which is a more effective strategy to retrieve the article “Ku, Y.-L., Sheu, S., & Kuo, S.-M. (2007). Efficacy of Integrating Information Literacy Education into a Women’s Health Course on Information Literacy for RN-BSN Students. Journal of Nursing Research 15(1), 67-77.”?  A. Combine search with author and date  B. using Boolean’s operator and keywords, such as: education AND nursing  C. using field search, such as limiting it to author and title of journal.

14. Which is the best searching strategy to locate breast feeding in adult women?  A. Breast feeding AND infant  B. Breast feeding (NOT adolescent) AND infant  C. (Women OR breast feeding) AND infant.

15. Which is the best next step for you in reducing the number of retrieved items when you used “health care” as a search term that resulted in 232 articles?  A. add more keywords  B. finding relevant articles through title reading  C. change search term as “health” and search again.

16. Which of the following is not appropriate for you to use in retrieving information for your academic assignment?  A. Google engine  B. Taiwan Journal Articles Image system  C. CEPS.

17. Which approach enables you to obtain a copy of a specific article from a library database such as Airiti Library?  A. Yahoo search  B. Taiwan Journal Articles Image system  C. Nationwide document delivery service (NDDS).

18. Which will be the best option for you to carry out another online search when you cannot find enough information from CEPS?  A. Google scholar  B. Taiwan Journal Articles Image system  C. Nationwide document delivery service (NDDS).


<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>75</td>
<td>79</td>
<td>70</td>
</tr>
</tbody>
</table>
It was important to ensure the items were of a suitable standard in regards to their degree of difficulty. An item analysis through the use of item difficulty was used to ensure the suitability of content selected for the OSKT. Item difficulty denotes the percentage of respondents who answer the item correctly. The maximum index of difficulty is 100%. Items with an extreme high or low difficulty level are likely to be too difficult or too easy, respectively. Hence, items that had difficulty levels around 50% were the most desirable to be included in the test (Cohen, Manion, & Morrison., 2011). Table 5 presents the item difficulty of the OSKT computed from a pilot study with 79 fourth year ADN students who were not involved in the current research. Item 4 was eliminated due to its extremely high correct response rate (97.9%) and all other items were considered and retained.

Table 5. Percentage of Correct Answers for Individual Knowledge Items

<table>
<thead>
<tr>
<th>No</th>
<th>n</th>
<th>(%)</th>
<th>Index of item discriminability</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>49</td>
<td>62.0</td>
<td>.23</td>
</tr>
<tr>
<td>2</td>
<td>55</td>
<td>69.6</td>
<td>.33</td>
</tr>
<tr>
<td>3</td>
<td>64</td>
<td>81.0</td>
<td>.30</td>
</tr>
<tr>
<td>4</td>
<td>73</td>
<td>92.4</td>
<td>.23</td>
</tr>
<tr>
<td>5</td>
<td>15</td>
<td>19.0</td>
<td>.23</td>
</tr>
<tr>
<td>6</td>
<td>58</td>
<td>73.4</td>
<td>.30</td>
</tr>
<tr>
<td>7</td>
<td>52</td>
<td>65.8</td>
<td>.35</td>
</tr>
<tr>
<td>8</td>
<td>53</td>
<td>67.1</td>
<td>.23</td>
</tr>
<tr>
<td>9</td>
<td>64</td>
<td>81.0</td>
<td>.30</td>
</tr>
<tr>
<td>10</td>
<td>19</td>
<td>24.1</td>
<td>.13</td>
</tr>
<tr>
<td>11</td>
<td>19</td>
<td>24.1</td>
<td>.13</td>
</tr>
<tr>
<td>12</td>
<td>58</td>
<td>73.4</td>
<td>.30</td>
</tr>
<tr>
<td>13</td>
<td>19</td>
<td>24.1</td>
<td>.13</td>
</tr>
<tr>
<td>14</td>
<td>12</td>
<td>15.2</td>
<td>.05</td>
</tr>
<tr>
<td>15</td>
<td>40</td>
<td>50.6</td>
<td>.46</td>
</tr>
<tr>
<td>16</td>
<td>59</td>
<td>74.7</td>
<td>.23</td>
</tr>
<tr>
<td>17</td>
<td>23</td>
<td>29.1</td>
<td>.13</td>
</tr>
<tr>
<td>18</td>
<td>38</td>
<td>48.1</td>
<td>.11</td>
</tr>
<tr>
<td>19</td>
<td>32</td>
<td>40.5</td>
<td>.22</td>
</tr>
<tr>
<td>20</td>
<td>35</td>
<td>44.3</td>
<td>.48</td>
</tr>
</tbody>
</table>

Note. N = 79

The experts highlighted the necessity to retain item 11 and 14 in this test because the two questions were deemed essential as they assess the research skills knowledge of students (despite the low correct response rate). Experts questioned items 5 and 10 because two concepts were addressed in one question, which created confusion for the participants as seen in the low percentage of correct responses (see Table 5). Item 17 asked participants about their knowledge regarding the use of library resources instead
of the scope of online searching. Finally, items 5, 10, and 17 were excluded. Again, a
scale-CVI value for this 16-item test was computed at .89, which was close to the
standard for an excellent content validity (Polit & Beck, 2006).

In line with the information literacy standards of the Association of College and
Research Libraries (ACRL), these 16 items, as shown in Table 6 below, included five
areas of knowledge: databases knowledge, basic searches knowledge, advanced
searches knowledge, information resources knowledge, and document type
knowledge (American Library Association, 2000). First, three items (1 to 3) were
used to test the databases knowledge of the participants, such as evaluating reliability,
validity, and accuracy of information. The second area, measured by four items (4 to
7), was the basic searches knowledge of participants in identifying keywords, using
synonyms, and in selecting a broader/narrower search scope. Third, five items (8 to 12)
were used to measure the advanced searches knowledge – the ability of participants to
construct a search strategy using tips such as Boolean operators and truncation. The
next two items (13 and 14) were used to measure information resources knowledge,
which is the ability to conduct searches via a variety of information retrieval systems.
Finally, two items (15 and 16) were used to measure the document type knowledge of
the participants; that is, measuring their knowledge of citation and referencing.

Overall, this section demonstrates the adequacy of the OSKT used in the research.
One score is given for each correct response; therefore, the total score from the
questionnaire ranges from 0 to 16. The higher score indicates a higher knowledge
level of participants in the area of online searches.

### Table 6. Final Online Searching Knowledge Test (16 items)

<table>
<thead>
<tr>
<th>Instruction: Please read each statement and circle the most correct response.</th>
<th>Educator</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which database would you use to search and download a nursing journal article with full text? A. CEPS  B. Taiwan Journal Articles Image system  C. Electronic Thesis &amp; Dissertations System</td>
<td>A 4  B 4  C 2</td>
</tr>
<tr>
<td>2. Which approach is best for you in searching information concerning the statistics for the birth rate of newborns in Taiwan? A. Yahoo engine  B. Electronic Thesis &amp; Dissertations System  C. the website of Department of Health, Executive Yuan, Taiwan.</td>
<td>A 4  B 4  C 4</td>
</tr>
<tr>
<td>3. Internet information can be used for academic assignments, except: A. <a href="http://www.twna.org.tw/frontend/un10_open/welcome.asp#">http://www.twna.org.tw/frontend/un10_open/welcome.asp#</a> (Taiwan Nurses Association)</td>
<td>A 3  B 3  C 3</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>C.</td>
<td><a href="http://www.prettyleg.com.tw/varicos_vein/varicos_vein.asp">http://www.prettyleg.com.tw/varicos_vein/varicos_vein.asp</a> (Dr. Lee Clinical)</td>
</tr>
<tr>
<td>4.</td>
<td>Which set below is best for you to locate information directly about the side effects of chemotherapy experienced by leukaemia patients? A. (leukaemia OR chemotherapy) B. (leukaemia AND chemotherapy) C. (leukaemia AND symptom).</td>
</tr>
<tr>
<td>5.</td>
<td>Which sentence below did not underline the main concepts (keywords) of the title? A. How to assist participants coping with the change in their body image after a colonostomy surgery? B. The self-care behaviour of diabetic patients C. The exploration of non-compliant behaviour of patients with hypertension.</td>
</tr>
<tr>
<td>6.</td>
<td>Which set below best represents the main concepts in the following sentence “how to assist the mother to cope the loss and grief concerning the death of their child due to brain cancer”? A. Cancer and grief B. Lost and coping C. Death and coping.</td>
</tr>
<tr>
<td>7.</td>
<td>Which set below best represents the main concepts in the following sentence “What are the health risks to women athletes who use anabolic steroids”? A. Women, females, Drugs. B. Women athletes, health risks, steroids. C. Drugs, athletes, performance.</td>
</tr>
<tr>
<td>8.</td>
<td>What is the truncation symbol used in Taiwan Journal Articles Image system to locate variants of search words, such as “teach,” “teacher,” and “teaching”? A! B. * C. #.</td>
</tr>
<tr>
<td>9.</td>
<td>What is truncation? A. Searches for variant endings to a word. B. Means that two words have to occur beside each other. C. Searches for any word in a search statement.</td>
</tr>
<tr>
<td>10.</td>
<td>In the following three options, which is a more effective strategy to retrieve the article “Ku, Y.-L., Sheu, S., &amp; Kuo, S.-M. (2007). Efficacy of Integrating Information Literacy Education Into a Women’s Health Course on Information Literacy for RN-BSN Students Journal of Nursing Research 15(1), 67-77.”? A. Combine search with author and date B. using Boolean’s operator and keywords, such as: education AND nursing C. using field search, such as limiting it to author and title of journal.</td>
</tr>
<tr>
<td>11.</td>
<td>Which is the best searching strategy to locate breastfeeding in adult women? A. Breast feeding AND infant B. (Breast feeding NOT adolescent) AND infant C. (women OR breast feeding) AND infant.</td>
</tr>
<tr>
<td>12.</td>
<td>Which is the best next step for you reducing the number of retrieved information when you used “health care” as a search term that resulted in 232 articles? A. add more keywords B. finding relevant articles through title reading C. change search term as “health” and search again.</td>
</tr>
<tr>
<td>13.</td>
<td>Which of the following is not appropriate for you to use in retrieving information for your academic assignment? A. Google engine B. Taiwan Journal Articles Image system C. CEPS.</td>
</tr>
<tr>
<td>14.</td>
<td>Which approach enables you to obtain a copy of a specific article from a library database such as Airiti Library? A. Yahoo search B. Taiwan Journal Articles Image system C. Nationwide document delivery service (NDDS).</td>
</tr>
</tbody>
</table>

### 4.4.2.2 Online Searching Skills Test

The aim of the Online Searching Skills test (OSST) was to evaluate the online searching skills of the participants. The completion of this test required the participants to conduct real online searches using library Chinese databases such as Airiti Library. This OSST was developed by the researcher and was based on suggestions of experts and existing literature (American Library Association, 2000;
Grant & Brettle, 2006; Rosenberg et al., 1998). Validation of this assessment tool was established through face validity and content validity because this was a dichotomous skills performance assessment tool rather than an interval or ratio scale with a large number of equidistant responses (Mooi & Sarstedt, 2011). The assessment items were divided into two parts based on the question being tested.

There were two questions with a total of 16 assessment items in the OSST. In Question 1, participants were required to locate and download an assigned article, and four assessment items were used to measure the participants’ basic searching skills while conducting the search. Question 2 was a relevant and realistic scenario describing a woman with health problems, and 12 items were used to measure participants’ advanced searching skills in relation to this scenario.

The face validity of this tool was established through consultation with five experts as previously described. All experts agreed with the appropriateness of the two questions used in appraising the online searching skills of the participants. However, several assessment items in Question 2 were modified according to the recommendations of the experts. For example, two items from the original assessment tool were merged into one. These two items were described as follows: The participants applied the field during their searches (item 2.9); and the participants correctly employed fields during their searches (item 2.10). Then a new item, which integrated both descriptions of these two items, emerged which described the participants’ correct use of fields such as “title”, “abstract”, and “journal” (item 2.5). Finally, four assessment items for Question 1 remained and the number of assessment items in Question 2 was reduced to seven. This test was scored on a scale of 0–11; a point for each feature of online searching skills that was used by the participants. The score was marked by an independent marker who was not involved in the current research project. A higher score from the participants indicates a greater level of searching skills.

23 The Airiti Library database provides two modules for information searching: quick search and advanced search. The former module allows the user to enter the title of articles and name of journal and authors to effectively locate specific articles in the database. The advanced module allows the user using keywords, Boolean logic, and limiters (language, document type, published area and year) to conduct information searches. Therefore, the searching skills test had questions in the two areas.
A content validity index (CVI) was used to examine the validity of the researcher-assessment tool using a similar process as previously; that is, where three nursing educators were asked to evaluate individual items on this assessment tool and then the CVI was calculated (see, Table 7). The experts rated items on a 4-point scale of relevance: 4=highly relevant, 3=quite relevant, 2=somewhat relevant, and 1=not relevant. Table 5 reveals that the item CVI (I-CVI) of the tool ranged between .83 and 1.00. Furthermore, a scale-CVI value of .97 was computed by averaging the I-CVIs which provides evidence for an excellent content validity of this assessment tool (Polit & Beck, 2006).

Table 7. CVI of the Online Searching Skills Assessment Tool

<table>
<thead>
<tr>
<th>Question 1: download the assigned article</th>
<th>Item No</th>
<th>Expert A</th>
<th>Expert B</th>
<th>Expert C</th>
<th>Item CVI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Academic database was used as an information resource</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1.2 Database with full text was used</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1.3 Fields were used (Ex: title, author, and journal was entered)</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>1.4 The required article was successfully downloaded</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

| Question 2: conduct a search based on a given scenario | 
|-----------------------------------------|----------|----------|----------|---------|
| 2.1 Used suitable keywords or phrases | 4 | 4 | 4 | 1.00 |
| 2.2 Advanced (combined) search was used | 4 | 4 | 4 | 1.00 |
| 2.3 Synonyms were used | 4 | 4 | 4 | 1.00 |
| 2.4 Boolean operators were used (two or more search terms were used) | 4 | 4 | 3 | .91 |
| 2.5 Fields were correctly used such as title, abstract, and journal | 4 | 3 | 4 | .91 |
| 2.6 Limits were used such as type of document, publication year, and areas | 4 | 3 | 3 | .83 |
| 2.7 Number of search results was manageable (<50) | 4 | 4 | 4 | 1.00 |

In brief, the CVI results supported the validity of use of the OSST in the current research as all CVIs ranged from .83 to 1.00. The tool is scored on a scale of 0–11 with a point for each conduct feature used. In addition, there were four rating items for Question 1 and seven assessment items for Question 2.

4.4.3 Section 3: Online Searching Self-efficacy Inventory

The Online Searching Self-efficacy Inventory (OSSI) is a simple self-report questionnaire with 12 items designed to measure the self-efficacy of the participants.
in relation to their searching skills. Each statement used a 10-point Likert scale, ranging from 1 (cannot do at all) to 10 (certainly can do). As a result, the total scale ranges from 12 to 120. This instrument was based on the ACRL Information Literacy Standard Two which indicates that information literate students can effectively and efficiently access needed information (Monoi et al., 2005).

The OSSI has been shown to be valid and reliable for measuring the online research skills self-efficacy of undergraduate students (Monoi et al., 2005). An exploratory factor analysis (EFA) technique was used with principal axis factoring to verify the construct validity of the OSSI. The internal consistency of the OSSI was examined by Monoi et al. (2005) using Cronbach’s α coefficients. The scale was administered twice to 108 participants, and the Cronbach α for the inventory at pre- and post-administration was 0.93 and 0.96, respectively. This result showed a higher estimate of reliability closest to 1.0 (Mooi & Sarstedt, 2011).

Before the use of the original English questionnaire, OSSI was translated into Chinese through group work by two bilingual nursing educators and one accredited translator (Flaherty et al., 1988). In other words, the original English versions of the questionnaires were translated into Chinese by two bilingual nursing educators who had studied in English speaking countries, such as Australia and the USA. Then, the translated Chinese questionnaires were back-translated into English by another accredited translator. The translator was ‘blinded’ to the original English version to reduce prior knowledge and to assess if the meaning of the translated Chinese OSSI was adequately reflected in the back-translated OSSI (Yu et al., 2004). Finally, a comparison between the wording of the original OSSI and their back-translated counterparts was undertaken by a native English speaking experienced psychosocial researcher in order to detect any possible alternations resulting from the translation (Brislin, 1970) (please see Appendix 5). The consistency of the meaning for each item statement between the original version and back-translated version were scored using a four-point rating system. The result of this comparison were very good as eight items were scored at 4 indicating a high consistency of translation and the rest of the four items were scored at 3 indicating moderate consistency.
4.4.4 Section 4: Self-Directed Learning Readiness Scale for Nursing Education

The Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) by Fisher et al. (2001) was applied in the current research to measure SDL readiness of the participants. This scale consists of 40 statements and uses a 5-point Likert scale anchored at 1=strongly disagree to 5= strongly agree. Moreover, three dimensions of self-directed learning are included. This scale allows for the assessment of attitudes, abilities, and personality characteristics necessary for students’ self-directed learning. Hence, three factors are included in the SDLRSNE (Fisher et al., 2001). They are:

- Factor 1: Self-management (13 items: 1, 2, 3, 4, 5, 6, 7, 21, 27, 28, 30, 32, and 36);
- Factor 2: Desire for learning (12 items: 9, 10, 12, 13, 14, 16, 22, 23, 24, 25, 26, and 29); and
- Factor 3: Characteristics of self-control (15 items: 8, 11, 15, 17, 18, 19, 20, 31, 33, 34, 35, 37, 38, 39, and 40).

The structure validity of the scale has been verified through the exploratory factor analysis procedure and it has internal consistency with Cronbach’s coefficient alpha. The Cronbach’s coefficient alpha for the total item pool (n = 40), self-management subscale (n = 13), the desire for learning subscale (n = 12) and the self-control subscale (n = 15) were found to be 0.92, 0.86, 0.85, and 0.83, respectively (Fisher et al., 2001). In addition, the validity and reliability of the scale were supported by further nursing studies (Fisher & King, 2009; Kocaman et al., 2009; Smedley, 2007; Yuan et al., 2012).

Before the use of the SDLRSNE in the current research, the original English written SDLRSNE was translated into Chinese and the forward-back-translation and verifying procedures completed (Brislin, 1970; Flaherty et al., 1988) as described in the previous section regarding the OSSI (Appendix 5). The consistency of meaning of each item statement between the original version and the back-translated version was scored using a 4-point rating system. The result of this comparison was very positive: 28 items were scored at 4, indicating a high consistency of translation, and 10 items
were scored at 3, indicating moderate consistency, despite two items needing to be further modified.

In summary, the two tests (OSKT and OSST) developed by the researcher were found to be appropriate for use in the current research. They were examined using face validity, content validity and item difficulty criteria. The use of OSSI and SDLRSNE in the current research contributed to the research rigour as the two scales were both valid and reliable and had a high level of internal consistency coefficient ($\alpha > .80$). The following section illustrates the usual instruction experienced by the participants in the control group and the intervention developed for the current study.

### 4.5 Usual instruction

The usual instruction in the current research involved a traditional face-to-face online searching skills instruction provided to the participants by a librarian, who was an experienced online searching skills educator with a Master’s degree from the Department of Library and Information Science. This teacher-to-group instruction was conducted with classes in a computer laboratory. Each student had a computer to facilitate active practice. The usual instruction lasted for one and a half hours.

There was structured collaborative learning through a group assignment for all students. In addition, students allowed requesting drop-in sessions from the lecture in assisting them to locate relevant information and complete their group assignments. These teaching strategies have been historically combined with a face-to-face instruction to support students’ learning.

The purpose of the instruction was to assist the participants to learn how to locate information through the use of library databases. The teaching content included the use of library databases and how to search through the use of keywords and searching strategies such as Boolean operators. Several databases were introduced, including Cumulative Index to Nursing and Allied Health Literature (CINAHL); however, one Chinese academic database, namely Airiti Library, was also included as it is the most popular database with full text for the participants. Advanced searching skills, such as
using Boolean operators and using a particular search field (e.g., title, publication year, and author’s name) were introduced. Students completed a brief hands-on exercise after the instruction to facilitate their knowledge transfer to enable them to complete an assignment. However, the hands-on exercise was limited due to time constraints. Following the librarian’s instructions, the students were required to complete a group project, which involved a scenario of a patient with particular health problems. The online searching skills of the participants enabled them to locate relevant information to compose a literature review session in their assignments.

4.6 The intervention

This section describes the intervention used in the research. First, the purpose of and background to the development of the intervention are addressed. Then, the theoretical foundation of the intervention and its implementation are illustrated. Thirdly, the four components of the intervention are described.

4.6.1 Aim of and background to the intervention

The intervention in the research refers to a web-enhanced educational program aimed to facilitate the associate degree study of nursing students using their online research knowledge and skills as they strive for self-efficacy and independence in learning.

The significance for nursing educators focuses on the online searching skills of graduates because these skills are the foundation of their information literacy. This is essential for nursing graduates because information literacy indicates the capabilities of individuals in accessing professional information, critical thinking, and problem solving necessary to deal with problems in clinical practice (Cheek & Doskatsch, 1998; Skiba, 2005). Also, the ability of nurses to access up-to-date peer reviewed empirical research is a prerequisite to evidence-based practice (Shorten et al., 2001). These skills can be given solely in a course; however, the best implementation of information literacy education is to integrate the research skills into nursing courses (Courey et al., 2006; Craig & Corrall, 2007; Ku et al., 2007; Wallace, Shorten, & Crookes, 2000). Moreover, the educational effectiveness of this type of learning will
be augmented through collaboration across disciplines (Brasley, 2008; Cha Tien-Yu 查天佑, 2008; Dorner et al., 2001; Innes, 2008; Miller et al., 2010).

The use of library databases and information search tools has not previously been included in the curriculum of the ADN program at Meiho University. However, the students have been expected to apply online searching skills to find appropriate information for the completion of their assignments. Furthermore, the online searching skills are required competencies to help students to solve the problems they will confront during their clinical practice period.

In order to test the effect of the intervention, it was embedded in the fourth year, first semester course “Case Study Discussion in Nursing” which requires online library database searching skills. This semester is the last semester before the students start a two-semester clinical practice period. The objectives of the course involve enabling students to understand the significance of writing a case report and its format; developing students’ research skills using academic databases and their ability to use the retrieved information; and developing their collaborative skills for work in teams.

The Associate Degree in Nursing Program in Taiwan is campus-based. However, the integration of e-learning has become a trend in a variety of educational institutions. Also, the use of a web-enhanced approach is encouraged by Meiho University as an innovative teaching strategy. Previous research has found that nursing students showed greater satisfaction with web-enhanced education than totally web-based learning (Buckley, 2003) and traditional face-to-face learning (Buckley, 2003; Kearns, Shoaf, & Summey, 2004; Salyers, 2005). Furthermore, the web-enhanced learning approach demonstrated its positive effects by producing higher academic scores amongst nursing students than traditional learning (Chen Shu-Wen 陳淑雯 et al., 2005; Salyers, 2007).

As a result, this intervention was embedded into the course “Case Study Discussion in Nursing”, and a web-enhanced approach was employed after the librarian had given the usual online research skills instruction. The following addresses the theoretical basis for the development of the intervention.
4.6.2 Theoretical foundation of the intervention

The Adult Learning Theory of Knowles and the problem-based learning approach were integrated as the theoretical foundation for the development and implementation of the intervention. This material is covered in detail in the Literature Review Chapter Section 2.3 and Chapter Three. The adoption of these two facets to guide the intervention in the current research was based on the knowledge that all the participants enrolled in one subject course “Case Study Discussion in Nursing” required the students to complete a group case report using a real health care patient problem. This group work case report pushed the participants to learn/improve their online searching skills using databases in order to immediately apply the skills to satisfy their learning needs. In addition, a number of studies have demonstrated the effectiveness of PBL in improving nursing students’ self-directed learning readiness (Kocaman et al., 2009; Williams, 2004), learning motivation (Ozturk et al., 2008), self-efficacy level (Dunlap, 2005), interpersonal skills such as communication skills (Schmidt, Van der Molen, Te Winkel, & Wijnen, 2009), and learning satisfaction (Schmidt et al., 2009).

Through the analysis of learning goals, content, situation, and characteristics of the participants, Andragogy in process learning model (Knowles et al., 2005) showed its fitness as the guideline to inform the development of the intervention in contrast to a pedagogical content learning model. This model, shown as rings in Figure 3 (See page 75, in Chapter 3), explains how the learning of adults will be influenced by situational differences. A web-enhanced education approach was used to support the participants in the experimental group to reach the goals in three areas: individual (gaining online searching knowledge and mastery of searching skills), institutional (having higher information searching confidence levels), and social (becoming more self-directed learners).

Individual learners are the focus of Knowles’ theory; therefore, developing a climate setting can motivate adults self-directed learning can be the most crucial element in the whole learning process (Knowles et al., 2005). This denotes that the development of the intervention emphasized the preparation of learners and a climate conducive to their learning. Therefore, a variety of components and strategies were used as
resources in assisting learners to acquire information and skills instead of simply
directly transmitting the information and skills. The components and teaching
strategies are addressed in the following sections.

4.6.3 Components of the intervention

Four components were integrated into the intervention to enhance learning efficiency
based on Knowles’ process learning model, and a thorough literature review of web-
enhanced learning was conducted.

As previously described in section 4.6.2, the learning climate is the focus of the
program because the intervention aimed to develop self-directed learning rather than
the transmission of knowledge or skills (Knowles et al., 2005). The learning climate
includes the physical environment; resources, which can be both material and human;
and the psychological environment. The richness and accessibility of resources is
crucial to effective learning (Knowles et al., 2005). Multiple media, interactive
learning activities, problem-based learning, and sufficient academic support were
integrated into this web-enhanced program to augment the involvement and
satisfaction of learners (Frey & Alman, 2003). Also, a group work was organized for
students to experience collaboration rather than competiveness (Knowles et al., 2005).

The four components are described in Table 8, and include a tutorial, a self-paced
online learning package, an online forum, and a drop-in session for consultation.
During the intervention period, participants in the experimental group had free access
to the web-enhanced educational program addressing academic databases to establish
a climate conducive to their learning. More detail regarding each component is
addressed below.
Table 8. Four components of the Intervention

<table>
<thead>
<tr>
<th>Component</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. A tutorial (50 minutes) facilitated by the</td>
<td>• A face-to-face small group tutorial.</td>
</tr>
<tr>
<td>researcher.</td>
<td>• To trigger brainstorming and participants’ discussions about their learning plan, the researcher presented a problem (assignment) that needed to be solved.</td>
</tr>
<tr>
<td></td>
<td>• An introduction about the web classroom was given to the participants to motivate their self-directed learning.</td>
</tr>
<tr>
<td>2. Self-paced online learning package (10</td>
<td>• These self-paced learning materials were accessible for 10 weeks during the intervention phase.</td>
</tr>
<tr>
<td>modules).</td>
<td>• Materials included slides, texts, interactive computer quizzes, videos, and hyperlinks to useful websites.</td>
</tr>
<tr>
<td>3. An online forum (facilitated by the researcher).</td>
<td>• This forum started from the week after the face-to-face tutorial and lasted at least four weeks.</td>
</tr>
<tr>
<td></td>
<td>• The participants were encouraged to join their online group discussion with free meal vouchers as rewards.</td>
</tr>
<tr>
<td></td>
<td>• The researcher regularly checked this online forum and gave feedback on participants’ inquiries and postings.</td>
</tr>
<tr>
<td>4. Drop-in session for consultation.</td>
<td>• Participants were free to request a drop-in session (individual/group consultation provided by the researcher) during the intervention phase.</td>
</tr>
<tr>
<td></td>
<td>• Each consultation was limited to 20 minutes.</td>
</tr>
<tr>
<td></td>
<td>• One appointment per week was permitted.</td>
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</table>

1. **The tutorial**

This face-to-face tutorial was used as a means to prepare learners to learn. During the intervention, the researcher played the role of facilitator instead of a teacher directly transmitting knowledge and skills (Knowles et al., 2005). The, tutorial took place in a spare University staff office in which there were two laptops available for this tutorial whenever it was necessary to access the e-classroom or databases. Members in each small study group (six to eight persons per group) and the researcher sat in a circle and undertook this informal group discussion.

These tutorials lasted about 50 minutes. The first 10 minutes was used to introduce how the tutorial would proceed and for a self-introduction of the researcher again. The following 30 minutes were used to discuss a real case that the participants intended to approach and the potential health problems of the client. A brainstorming strategy was used to facilitate interaction amongst the group members. The discussion was triggered by the need to complete an assignment given by the course lecturer. The last 10 minutes was used to conclude a discussion summary, and to remind the participants to access the web-classroom (provided by the researcher) in which they could undertake their self-directed learning and online group discussion.
2. **Self-paced online learning package**

The design of the 10-module self-paced learning package was based on the learning goals and the knowledge gaps in the learners (Knowles et al., 2005). Four pre-test focus group discussions were held before the determination of the content framework of the package. This process matched the Andragogical model in that the learners participated in the planning and assessment of their learning needs. Moreover, the problem-solving focused content enhanced the learning package (Atan, Sulaiman, & Idrus, 2005). Additionally, a variety of media and activities were incorporated in this package to increase the experiential learning of the participants, including Power point, Power Cam, videos, interactive computer quiz, and discussion board.

Since this online learning package was not a compulsory program to be integrated into the subject course, the learning objectives of this package did not cover the whole range of capabilities as described by the American Library Association (2000) or previous research (Tarrant et al., 2008). The overall learning objectives of this self-paced online learning package are described as follows.

**Objectives of the package:**

1. To recognize the need for information.
2. To determine the best resource to locate and retrieve the information for academic writing.
3. To retrieve the required information via the use of library databases.
4. To critically evaluate the information.

**Contents of the package**

The variety of topics included in this package were based on the principles of Knowles’ theory and previous research regarding information literacy and databases searching education (Griffith University Library, 2011; Schutt & Hightower, 2009; Tarrant et al., 2008). More details of the 10 modules are provided in Table 9 (see page 106). Furthermore, each module was broken down into small manageable units (25-30 minutes) (Frey & Alman, 2003). These technology-medium modules were only available for the participants in the experimental group to enhanced their learning performance, self-efficacy and self-directed learning in a 10 week period (Falco, 2008;
Gabrielle, 2003). These modules were sequentially uploaded to the web-classroom in e-platform of Meiho University.

3. Online forum

Online communication is an essential element of an online program based on the principles of adult learning (Frey & Alman, 2003). The implementation of the online forum was guided by the principles of PBL, which promotes a collaborative and supportive learning environment (Wilkie & Burns., 2003). After the completion of the face-to-face tutorial, participants in each small study group (six to eight persons per group) started a cycle of problem-based discussions (Barrows & Tamblyn, 1980). Each small study group had its own online forum that nobody could access except members within the group, the course lecturer and the researcher. The course lecturer was not involved in the interactive online learning activity.

Each group of participants elected a group leader who usually initiated their online group discussions. Interaction with and collaboration of the participants occurred throughout these sessions, which included reciprocal questioning and responding activities. Participants were asked to participate in at least three discussions within a four week period (Baker, 2001).
<table>
<thead>
<tr>
<th>Module topic</th>
<th>Objectives</th>
<th>Module content</th>
</tr>
</thead>
</table>
| Module 1: The significance of information searching skills in nursing | • Acknowledge the importance of online searching skills in nursing  
• Recognize the need for information searching | • The role of online searching skills of nurses and their life-long learning  
• The function of effective online searching skills of nurses in their evidence-based practice.  
• The relationship between online searching skills of nurses and their problem-solving abilities.  
• Information searching experiences of nursing faculty  
• Information searching experiences of peers |
| Module 2: Analysis of your topic | • Clarify your topic | • Principles of identifying your topic  
• Marking criteria  
• Writing content  
• Activity-brain storming |
| Module 3: Identifying Sources | • Choose the best information sources for your assignment  
• Locate information sources in the library collection | • What do I need to find?  
• Sources of information  
• Why retrieve information from library databases?  
• Why not use website information? |
| Module 4: Basic information searching skills | • Identify the keywords in your topic  
• Identify Synonyms  
• Chose the appropriate Boolean operators | • The definition of keywords  
• How to identify keywords  
• The use of synonyms  
• What are Boolean Operators?  
• Choosing appropriate Boolean operators |
| Module 5: Advanced searching skills and strategies | • Using fields, limits, truncation symbols and wildcards to develop more effective search statements | • The use of fields and limits for information searching  
• Using truncation and wildcards for information searching  
• Developing search statements  
• Useful websites to advance your information searching skills |
| Module 6: The search tools in the library | • Find items held in the library  
• Find articles published about your topic  
• Choose the best academic database for your assignment  
• Find academic websites about your topic | • The most popular Chinese electronic databases in nursing  
• The most commonly used English electronic databases in nursing |
| Module 7: Demonstration of the use of library databases | • Be competent in using library databases | • Demonstration 1- Searching information via Airiti Library  
• Demonstration 2- Searching information via PerioPath Index to Taiwan Periodical Literature System  
• Demonstration 3- Searching information via CINAHL |
| Module 8: Evaluating Information | • Critically evaluate the retrieved information | • Principles of information evaluation |
| Module 9: Using Information | • Understand copyright, your rights and responsibilities  
• Understand plagiarism and your responsibilities  
• Start referencing your information sources | • What is copyright?  
• What are your rights and responsibilities in using information?  
• What is plagiarism?  
• How to avoid plagiarism?  
• Using referencing  
• Referencing style –APA format |
| Module 10: Self-assessment testing | • To do self-evaluation of online searching knowledge and skills. | • Interactive computer test, including multiple choices, open-ended, and fill in the blank questions. |
The participants were informed that the researcher/tutor would join their group discussion to provide academic support. The researcher checked and regularly responded to their postings. These responses were prompt and positive in order to create a respectful learning atmosphere and facilitate the engagement of students (Garrison & Kanuka, 2004; Knowles et al., 2005). Furthermore, participants were encouraged to bring their own assignments (real-world problems) to this online forum to motivate their learning (Knowles, 1970). One thing worth mentioning is that the researcher did not directly instruct students on how to manage their problems or how to construct their searching strategies. However, based on the principle of using reasoning processes (Barrows & Tamblyn, 1980), a four-step set of guidelines was used to facilitate their critical thinking to find a solution which met their learning needs through group discussion (Table 10).

Table 10. Problem-Based Discussion Facilitation Guidelines

<table>
<thead>
<tr>
<th>Steps</th>
<th>Description</th>
</tr>
</thead>
</table>
| Guide 1 | • What is the first step for completing this assignment?  
• Where will you find useful information for this assignment?  
• Which search method is more efficient?  
• How will you start an information search? |
| Guide 2 | • What is the result of your information search based on the resolution through group discussion in the previous step?  
• How can you manage this when the information is irrelevant?  
• How can you manage this when the information is voluminous or insufficient? |
| Guide 3 | • Try to search information again in accordance with the conclusion of your group discussion in the prior step.  
• What is the applicability of the information that you retrieved this time?  
• How will you select the suitable articles for your assignments?  
• What kinds of articles do you require? (Review the conclusion at prior steps.)  
• What are the main concepts and key words of articles that you will select? |
| Guide 4 | • What are the search strategies and inclusion criteria for information for your group homework?  
• Please present this discussion result, including main concepts, key words, searching strategies, inclusion and exclusion criteria for selecting articles.  
• Please scrutinize the solutions of other groups and give your opinions on their solutions. |

4. **Drop-in sessions**

Participants were able to request a drop-in session (an individual/group consultation provided by the researcher) during the intervention phase. This component provided participants with access to human resources (Knowles et al., 2005) and social presence during the intervention (Garrison & Vaughan, 2007). The session also provided participants with an alternative source of academic and psychological
support. The sessions were scheduled every Tuesday morning (8am-12pm) and Thursday afternoon (1pm-5pm). In order to provide sustainable support, this drop-in session was open to each participant for 20 minutes per week during the intervention period.

4.6.4 Intervention fidelity

Several methodological strategies were applied to enhance the reliability and validity of the educational intervention (treatment) so that it could be faithfully delivered as per the research plan. In order to control the influence of variables in learning outcomes, two groups of participants with similar educational background such as age, enrolled in the same course, and data collecting at the same period of time were applied. The intervention was provided only by the researcher, which reduced the likelihood of differential outcomes by different providers, and through provider-treatment interaction thus ensuring consistency (Bellg et al., 2004). Information literacy education was separately given to the control group and the experimental group by the same librarian at a computer laboratory in order to reduce research contamination. Furthermore, participants in the control group was not given the password to access the online forum and online learning package that was available to the experimental group members who were asked not to share this with members of the control group.

The developed education manual clearly defined and outlined key elements, procedures to follow, and guidelines for delivering different components of the intervention (please see section 4.6.3). This ensured the researcher gave each participant in the experimental group the same intervention including the same fixed length, number, and frequency of contact sessions with the researcher, and a fixed amount of information through using the computerized learning modules (Horner, 2012).

In summary, the intervention used in the research was a web-enhanced online searching skills educational program. Principles of Knowles’ Adult Learning Theory and of Problem-Based Learning informed the development and implementation of the intervention. The central focus of the intervention was to establish a climate
conducive to acquiring the identified research skills. Four components were included in the learner-centred, interactive, web-enhanced program, including an initial face-to-face tutorial, drop-in sessions, an online forum, and 10 modules of online learning materials. This Andragogical learning model spanned a 10 week period. Several strategies were employed to enhance intervention fidelity. Further details concerning the implementation of the intervention are provided in the next section of this chapter.

4.7 The implementation of the intervention

This section addresses the implementation of the intervention. As shown in Figure 5, the duration of this intervention was 10 weeks, between the second and twelfth week of semester one, 2011, at Meiho University (the mid-term examination week - week 9 - was excluded). Following the usual online search skill instruction given to the participants by the librarian, the intervention group participated in the integrated components of an Andragogical process model for learning.

![Andragogical process model for learning](image)

**Figure 5. Flow Chart of the Intervention**

During the Andragogical process, the participants had free access to the online self-paced learning package, which included 10 modules. Each module took almost 30 minutes for the participants to work through. Another component was a tutorial, which was face-to-face and facilitated by the researcher. This tutorial aimed to
encourage the engagement of the learners in two self-directed learning activities - an online learning package and an online forum - included in the current research. The third component was drop-in sessions, which were available to participants once a week when they requested. The last involved an opportunity to participate in a cycle of problem-based online group discussions. The participants initiated an online forum after they had received a tutorial. The participants were informed that three of the interactive online discussions should occur during the intervention period.

The following section describes how the principles of Problem-Based Learning were integrated into the intervention, as shown in Figure 6 (Barrows & Tamblyn, 1980; Wood, 2003). First, the participants were grouped into small groups (six to eight students in one group), then they were required to participate in online group discussions. As part of the intervention, participants in the experimental group received a 50 minute group tutorial (stage one) before the self-directed or problem-based learning period. This tutorial was undertaken after classes. In this tutorial, the researcher presented the participants with a learning task (a problem needs to be solved) and explained how the intervention could assist them through the online forum and self-paced learning package.

Figure 6. The Process of Integrating Problem-Based Learning into the Intervention

Stage two refers to the period of time when the participants were required to complete the online learning activities, including independent learning through the use of the learning package and joining the online group discussions. The participants could access to the package at any time; in addition, the online forum was facilitated by the researcher in accordance with the principles of Problem-Based Learning. The group
discussions addressed a single problem, a case study from the real world, and through
the discussions it was posited that the participants would find a solution to allow them
to complete their assignment (Baker, 2001). The participants actively discussed the
case in the online forum, and the written texts and postings were able to be re-visited
at any time (Wilkie & Burns., 2003). Within this stage, the participants needed to
study independently and conduct group discussions (Baker, 2001). These interactive
problem-solving discussions aimed to move their learning approach from superficial
to deep, and to shift them from passive knowledge acquisition to active construction
of knowledge (Wilkie & Burns., 2003). In order to facilitate the engagement of
participants, the researcher regularly checked their online forum and gave prompt
feedback to students’ postings throughout this stage. Eventually, in stage three, a
solution for their online searches would be generated through the dynamic group
activities. Additionally, individual consultations were provided by drop-in sessions
during the intervention period in which the researcher assisted the participants to
resolve issues through problem-based discussion.

In summary, the implementation of the intervention occurred after the participants
received the usual face-to-face instruction given by the librarian in the second week of
the semester. Then, the participants went through an Andragogical learning model
(the intervention) in which they experienced four components of learning activities
until the twelfth week of the semester. The following sections will address the data
management of the research.

4.8 Data collection procedure

Data in the current research were collected using both quantitative and qualitative
approaches. Phase I was the recruitment of participants and group allocation. In phase
I, baseline data were generated using questionnaires. Four pre-test focus groups were
employed to explore the online searching knowledge and skills of the participants and
their learning needs. This understanding of the participants enabled the researcher to
develop an appropriate intervention conducive to their learning needs (Knowles et al.,
2005).
Phase II, the intervention period was followed by phase III which involved the collection of both quantitative and qualitative data sequentially. The same questionnaires were used in phases I and III, with the background questions removed for the phase III round of surveys.

To ensure research bias did not occur, two research assistants delivered the questionnaires to participants (Polit & Beck, 2012). The researcher and the course lecturers were not involved in the administering of surveys to participants, nor in assisting with the completion of the surveys or facilitating the timely return of questionnaires. A semi-structured focus group discussion method was used to collect qualitative data.

**Focus Groups**

Several strategies were used to create a comfortable and safe atmosphere for the focus groups (Polit & Beck, 2012; St John, 2004). The group discussions were undertaken in a comfortable air-conditioning meeting room at Meiho University. Refreshments were provided both during the pre-test and the post-test focus group discussions. Additionally, in order to establish rapport between the participants and the researcher, the latter regularly joined the class and interacted with the participants during the class breaks through the 10 week period. In the focus groups, the participants and the researcher sat in a U shape around a meeting table.

Each focus group discussion lasted for approximately one and a half hours. This avoided respondent fatigue and allowed sufficient time for deliberations (Egerod & Bagger, 2010). Each focus group discussion was divided into three stages: warm-up, interaction, and conclusion.

Refreshments were provided immediately after the arrival of the participants to facilitate informal interactions amongst them and the researcher, before the formal discussion took place. This warm-up stage, on average, took 20 minutes, after which the focus groups moved into the interaction stage. The interview questions included four semi-structured questions (please see page 79) prepared by the researcher or topics posed by the participants. The interaction stage lasted from 40 to 60 minutes, followed by a conclusion stage during which the researcher debriefed the participants.
Meanwhile, each participant was asked to provide final comments that reflected their overall perspectives on the discussion topics.

In order to keep the discussion moving and the group focused, several strategies were employed by the researcher (Tashakkori & Teddlie, 2003). She used a semi-structured question guide to focus on the research interests. However, sometimes the researcher asked the participants questions that emerged from their discussions and asked them to give authentic examples to clarify their answers. To ensure all participants had the opportunity to voice their opinions, encouragement was given to reserved or passive participants. For example, the researcher immediately asked passive participants to express their opinions when she observed nonverbal responses from them such as nods and head shakes. Additionally, the researcher redirected the discussion if the discussions were veering to topics irrelevant to their learning experiences using some techniques such as giving a brief to interrupt the irrelevant discussion and re-continuing focal discussions.

During the group interviews, the participants’ remarks were recorded on a digital recorder and then the recording was fully transcribed verbatim in Chinese. These transcripts were transcribed analysed by the researcher and then transcribed into English. Similarly, a forward-translation and back-translation procedure and verifying procedure, as earlier mentioned in section 4.4.3, was used in these transcripts.

4.9 Data analysis

4.9.1 Quantitative data analysis

This section describes data entry, screening and cleaning of the data, and statistics that were used in the research. Further, the criteria for determining the statistics and the additional principles used are described. Finally, the data were entered and analysed using the Statistical Package for Social Science (SPSS), version 19, personal computer version.

1. Data entry
To avoid errors in data entry, the data were entered by two research assistants. One assistant entered the data; the second assistant verified that the data had been entered correctly by comparing the computer-based data with the original data sheets. Verification occurred constantly during the data entry phase.

2. **Screening and cleaning the data**

Before data analysis was undertaken, the data set was checked for errors and to detect any existing outliers. In addition, the data entry was checked again by the researcher herself thus ensuring accurate data for analysis. The data were also checked by way of looking for minimum and maximum values. For example, in relation to categorical variables such as gender, the data were coded and entered 0 = male and 1 = female. Thus, only 0 and 1 were reasonable values for the gender variable. All continuous variables in the research - such as age of the participants, knowledge testing scores, and self-efficacy scores of the participants - were checked using descriptive statistics to identify out of range values. A similar checking procedure as the one applied to categorical variables was performed. Finally, the screening and cleaning procedures yielded a data set that had no missing or out of range values.

3. **Analysis to answer research Questions**

Three criteria were used in the selection of the statistical analyses in the research: research question, level of measure of the variables, and assumptions underlying the statistics (Pallant, 2011). Additionally, some useful statistical principles were employed to reduce the statistical biases.

Paired-sample t-tests were used to examine the Research Questions 1 to 4. These four questions aimed to compare the differences in online searching knowledge, skills, self-efficacy, and self-directed learning readiness of the participants before and after the intervention period. These four outcome variables were measured on either ratio or continuous scales. The data met the assumptions for the paired-samples t-test: observations are independent within groups, and the variables were normally distributed in the population (Yockey, 2011).

However, when multiple t-tests are run using the one data set, the probability of a Type I error increases, reflecting the number of t-tests (Pallant, 2011; Polit & Beck,
2012). For example, one t-test with $\alpha = .05$ has a 5% probability of a Type I error; however, with three t-tests the error risk increases to 14.3% (Polit & Beck, 2012). A Type I error refers to the researcher’s rejection of a true null hypothesis. This error might cause the overestimation of the effectiveness of a treatment. Therefore, the Bonferroni correction was applied. Normally, the most frequently used significance ($\alpha$) level is .05, yet, for the purposes of the Bonferroni correction, the desired $\alpha$ was divided by the number of tests; that is, $.05/4 = .0125$ ($p < .0125$) to reduce the likelihood of a Type I error (Polit & Beck, 2012).

Research Question 5 examined the differences in online searching knowledge, skills, self-efficacy, and self-directed learning readiness of the participants between the two groups after the intervention period. Since this current research was not a randomisation trial, pre-existing differences between the two groups might occur, although the homogeneity of the two samples in their pre-test scores was examined and found to be true (Polit & Beck, 2012). As a result, a multivariate analysis of covariance (MANCOVA) analysis was employed because this analysis permits post-hoc statistical control of such extraneous variables to reduce systematic bias and within-group error variance (Pallant, 2011; Stevens, 1996). After the underlying assumptions were checked and were found to meet the criteria through preliminary analysis, a MANCOVA was performed. The underlying assumptions included:

1. Covariate is measured before the intervention;
2. Covariates are not strongly correlated with one another;
3. Homogeneity of variance of covariates;
4. Linearity - the relationship between the dependent variable and the covariate for all groups;
5. Homogeneity of regression slopes - the relationship between the covariates and the dependent variables is the same for each of the groups; that is, the slopes are equal for all cells (there is no interaction between independent variables and covariates) (Pallant, 2011; Tabachnick & Fidell., 2007).

### 4.9.2 Qualitative data analysis
All audio recordings in the pre and post test focus groups were fully transcribed verbatim into Chinese. Coding was used as an analysis strategy to organize, order, and sort the data. A free-form of coding was employed because the data were used as supplementary information to inform the development of the intervention and to explore the research questions from different perspectives (Annells & Whitehead, 2007).

The written form of data from the pre-test focus groups was cycled through a three step process and was transferred back and forth to generate concepts (fracturing, grouping, and gluing). The three steps involved in the free-form analysis procedure are addressed below (Table 11). A line-by-line code was used for the pre-test focus groups data analysis in the current research. The researcher carefully examined the words, phrases, or sentences to allow immersion into the data; thus, a code could be generated through a repeat comparison and contrast procedure amongst transcripts (Holloway & Wheeler, 2010). Then all identified codes were logically grouped as categories. Those categories that were found to have an existing hierarchical relationship were then ordered. Eventually, themes from these pre-test focus group discussions emerged through the conceptual ordering process.

### Table 11. Phases of Free-Form Analysis

<table>
<thead>
<tr>
<th>Step</th>
<th>Identified and listed descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Fracturing</td>
</tr>
<tr>
<td></td>
<td>Identify codes through line-by-line code or scanning paragraph for unit of meaning.</td>
</tr>
<tr>
<td>2</td>
<td>Grouping</td>
</tr>
<tr>
<td></td>
<td>Categorisation: gather the abstracted and fractured codes into logical groupings.</td>
</tr>
<tr>
<td>3</td>
<td>Gluing</td>
</tr>
<tr>
<td></td>
<td>Conceptualisation: discover the relationships amongst the groupings and link the groupings accordingly.</td>
</tr>
<tr>
<td></td>
<td>Conceptual ordering: place the groupings into a hierarchy, such as category and multiple sub-categories.</td>
</tr>
</tbody>
</table>

**Note**: This table cited from Annells and Whitehead (2007).

Visioning the data was different between the pre-test and the post-test focus groups during the analysis. In the post-test focus groups, the responses of the participants were analysed into sub-theme categories relevant to study objectives (McQuarrie, 2006). These categories included information related to the five research questions used in the current study and the six assumptions of Knowles’ Adult Learning Theory (Annells & Whitehead, 2007).
To demonstrate credibility in data analysis, categories and themes were identified by two reviewers, in other words, through peer debriefing (Holloway & Wheeler, 2010; Morrow, 2005). The researcher and another experienced colleague (with a PhD degree in nursing) regularly discussed the coding and collaborated several times to review data and to discuss the categories. Coding schemes were generated through a formative and iterative process. In addition, the two reviewers independently read through the transcripts and generated possible categories. These categories were not refined until agreement was achieved between the two reviewers.

4.9.3 Trustworthiness of qualitative data

Several procedures were used to establish the trustworthiness of the qualitative data from the current research (Graneheim & Lundman, 2004; Lincoln & Guba, 1985; Morrow, 2005). Initially, a summary of transcripts from each focus group’s discussions was given to the participants who were permitted to validate the interpretation of their own responses. This member-checking strategy strengthened the credibility of the research (Holloway & Wheeler, 2010).

Peer debriefing and a self-reflective journaling were methods used to establish confirmability (Holloway & Wheeler, 2010; Morrow, 2005). Throughout the current study, the researcher regularly held discussions with peers, qualitative experts, in order to reduce research bias in the analysis (Holloway & Wheeler, 2010; Morrow, 2005). The reflective journals were maintained to record and, intermittently, to review the researcher’s thinking and decisions (Corbin & Strauss, 2008b; Morrow, 2005). This stimulated the researcher to read more widely about the credibility of qualitative research. It also helped the researcher in her role during the focus groups discussions process (Holloway & Wheeler, 2010). During the data analysis period, the researcher regularly had discussions with a qualitative expert who served as a mirror reflecting the responses of the researcher to the data analysis. Also, to ensure reflexivity, the researcher kept an analytical/reflective journal which was an ongoing record of her experiences, reactions, and emerging awareness of any assumptions or biases that came to the fore. The researcher’s reflections on the meaning of original words used
by the participants and feelings that were stimulated during the analytical process were recorded. This helped with transparency in the data analysis process (Ortlipp, 2008).

Furthermore, the researcher sat in the classroom and observed these students studying in the course to enhance her sensitivity to and reflexivity concerning the research phenomena. The researcher acted as a tutor who was familiar to all the informants in the focus groups. This increased the rapport with the participants and provided a sense of equality between the researcher and the participants. This encouraged the participants to voice their real experiences and feelings with comfort; therefore, the validity of data collection was enhanced (Corbin & Strauss, 2008a; Grbich, 1999; Polit & Beck, 2012).

4.10 Ethical considerations

This section describes the procedures that were used to protect the rights of participants in this project. According to the National Statement on Ethical Conduct in Human Research in Australia (National Health and Medical Research Council, 2014), several principles should be followed, including respect for human beings, research merit and integrity, justice, and beneficence. These principles aim to shape trustful, mutually responsible, and ethical equitable relationships between researchers and research participants. Three research ethical principles will be addressed in sequence: voluntary participation, non-maleficence, anonymity and confidentiality (National Health and Medical Research Council, 2014; Polit & Beck, 2012; Sarantakos, 2005; Taylor, Kermode, & Roberts, 2006). To ensure participants were fully informed of their rights and voluntary participation for this study, the researcher obtained ethical approval from both Meibo University and the Griffith University Human Research Ethics Committee before conducting this project (Appendix 1). Prospective participants were informed verbally and in written form in Chinese regarding the background and purpose, and procedures and benefits of this study. They were also subsequently informed that participation in this study was voluntary, and that their right to withdraw at any time without explanation was permitted (Appendix 2). Hence, participants were self-determining regarding their participation (Grbich, 1999).
Participants also were informed that they might withdraw from this study at any time without penalty or loss of benefits, such as to their academic results. However, during this study, if participants requested other support in respect to their learning, they were given information to contact a counselling service for assistance, without charge. Also, participants in the focus group discussions had been given a brief summary of transcripts as feedback.

Participants were informed that their responses would remain confidential and anonymous. They would not be personally identified through the data collection process, the transcripts, or in any subsequent discussions amongst the research team members, or through any form of publication. The data were entered into a computerized database through the use of a code number or a pseudonym to protect the identity of the participants. All the information would be securely held by the researcher for five years and would not be discussed with any other individual, except in aggregate form. No individual would have access to the data except the author and, after the conclusion of the enquiry, the data and recorded tapes would be erased as soon as possible.

### 4.11 Summary

This chapter provides details of the research methodology, a mixed methods design with questionnaires and focus groups to test the effectiveness of web-enhanced education addressing online searching skills in Taiwanese ADN students. A written information sheet and consent was given to the potential participants before the start of the research. Immediately on receipt of the consent forms by the researcher, a total of 142 participants completed the pre-test and post-test. The experimental group received a web-enhanced online searching education based on Knowles’ Adult Learning Theory and PBL; the control group received the usual face-to-face instruction. The effectiveness of the intervention was measured by the change in participants’ online searching knowledge, skills, self-efficacy, and self-directed learning readiness. Focus group discussions were used to refine materials for the educational intervention and to collect supplementary data from participants before
and after the intervention period. The analysis of quantitative data was computed by the Statistical Package for Social Science (SPSS), version 19 (2011); and a free-form analysis was used to analyse the qualitative data in the current research (Annells & Whitehead, 2007). The next chapter will address results of the current research.
Chapter 5: Results

This chapter presents the results before and after the intervention period of the current study. The data related to the sample response rate, background of the participants, and the results of testing research questions are sequentially addressed in this chapter. Quantitative data were used to establish the differences between two certain timings (pre-test and post-test) and the two groups (the control and the experimental). Qualitative data were used to establish the participants’ experiences.

5.1 Sample response rate

The initial eligibility sample of participants was drawn from 292 Associate Degree in Nursing (ADN) students in six classes. A cluster sampling method was used: Each class was drawn using a box containing six papers, nominating a respective class, following which the first four classes were allocated into either the control or the experimental group. However, 26 participants in the selected four classes refused to participate (without giving a reason), and 12 participants did not meet inclusion criteria and were therefore excluded. A total of 170 participants completed the pre-test questionnaires; 87 participants were in the control group and 83 in the experimental group. Before the intervention phase, two pre-test focus groups (12 and eight participants, respectively) from the control group and another two focus groups (12 and eight participants, respectively) from the experimental group were formed. There were three males (15%) and 17 females (85%) in the experimental group and 20 participants, all females, in the control group.

After the intervention period, 28 participants withdrew from the study and failed to complete the post-test questionnaires. Eventually, the sample size in the control group was 87, with 73 participants completing the two questionnaires, representing an attrition rate of 16.1%. The experimental group recruitment sample was 83 participants, with 69 remaining in the study, representing an attrition rate of 16.9%. The sample size in met the required number of 86 students in both the control and experimental groups. After the intervention period, two focus groups (12 and five
participants, respectively) from the control group and another two focus groups (12 and 10 participants, respectively) from the experimental group were formed. There were three males (13.6%) and 19 females (86.4%) in the experimental group, and 17 participants, all females, in the control group. A flow diagram (Figure 7) depicts recruitment and retention information through each phase of the current research.

---

**Figure 7. Flow Diagram of Participants’ Progress**
5.2 Backgrounds of participants

The backgrounds of participants are reported and include their demographic characteristics; previous web-enhanced and database learning experiences; existing online learning and searching experiences; and computer and the Internet competency. A 10-item questionnaire was used to measure participants’ online learning and searching experiences, as well as their computer technology literacy. The following is a backgrounds description of the participants and the comparison between the control and the experimental groups.

Demographic data of participants Age

The mean age of the participants between the two groups was very similar, with the control group \( n = 73 \) at 18.33 years (SD = .48) and the experimental group \( n = 69 \) at 18.32 years (SD = .50). In order to ensure the homogeneity of the two groups before the intervention, a two-sample t-test analysis was used to examine the statistical comparison of the mean age of the two groups. The following assumptions underlying the test were first examined:

1. a continuous scale is used to measure the dependent variable, such as at the interval or ratio level;
2. the scores are obtained via a random sample from the population;
3. the independence of the observation/measurement;
4. the scores on the dependent variables are distributed normally;
5. samples are obtained from a population of equal variance (Pallant, 2011).

The age ranges in both groups were not normally distributed as indicated by the Kolmogorov-Smirnov test \( p < .001 \). Two types of analysis test were considered. The Mann-Whitney test, a nonparametric test without the restrictive assumption about the shape of the variables’ distribution, could have been used (Field, 2009). However, a parametric test (two-sample t-test) is more powerful than the Mann-Whitney test. Statistical studies have suggested that a sample size of 50 or greater, as in the case of the current research, overcomes the problem associated with a nonnormal distribution
(Burns & Grove, 2009; Polit & Beck, 2012). As a result, in this current research, a two-sample t-test analysis was used.

Finally, the homogeneity of age between the two groups was assumed by Levene’s test for equality of variances (F = .02, p = .90). As shown in Table 12, an independent samples t-test revealed that there was no statistical difference in the age of participants in the two groups (t = -.22, df = 140, p = .823).

### Table 12. Comparison of Mean Age between the Two Groups

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Control (n = 73)</th>
<th>Experimental (n = 69)</th>
<th>t Value</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years</td>
<td>18.33 (.48)</td>
<td>18.32 (.50)</td>
<td>.22</td>
<td>.823</td>
</tr>
</tbody>
</table>

### Gender

Almost all of the participants were female: two males (2.7%) and 71 females were in the control group; four males (5.8%) and 64 females were in the experimental group. The homogeneity of gender distribution of participants between the two groups was checked by a Fisher’s exact test. This analysis was performed to examine independence as the variable was categorical in nature; and is also appropriately performed when there are cells with small frequencies (5 or fewer) (Field, 2009; Pallant, 2011). The assumptions underlying a Fisher’s exact test include:

1. data are measured on nominal or ordinal scales;
2. independent observation is used; each participant can be counted only once (Pallant, 2011).

Before conducting Fisher’s exact test, the underlying assumptions were checked and the data met those assumptions. Finally, a Fisher’s exact test, p = .432, was computed: This indicated that there was no significant difference between the two groups related to gender, as shown in Table 13.
Table 13. Number and Percentage Distribution of Gender of the Participants

<table>
<thead>
<tr>
<th>Gender</th>
<th>Control (n = 73)</th>
<th>Experimental (n = 69)</th>
<th>Exact Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>2 (2.7%)</td>
<td>4 (5.8%)</td>
<td>.432</td>
</tr>
<tr>
<td>Female</td>
<td>71 (97.3%)</td>
<td>64 (94.2%)</td>
<td></td>
</tr>
</tbody>
</table>

In brief, the statistical analysis shows that there is no significant difference in the two groups of participants in their demographic characteristics of age and gender.

It was important to assess any existing differences in previous learning backgrounds between the two groups that might influence the performance of the participants in their post-test measures. The results of a homogeneity examination of certain variables are described in the following paragraphs. Then, remarks of the participants from the four pre-test focus group discussions, which provided more explicit learning backgrounds of the participants, are addressed.

**Previous web-enhanced learning experiences**

Participants were asked about their prior web-enhanced learning experiences through a 10-item survey as different web-enhanced learning experiences between the two groups might influence the effects of the intervention in the research. A Chi-squared analysis was performed to examine independence as the variable was categorical in nature; no underlying assumptions previously described were violated. However, in this case, a Yates’s correction for continuity was used because it was a 2 x 2 table (Pallant, 2011).

The data revealed that the majority of participants in the two groups had prior web-enhanced learning experiences; but there was no significant difference in previous web-enhanced learning experiences between the two groups before the intervention. In the control group, 62 out of 73 (84.9%) participants had prior web-enhanced learning experiences, and 56 out of 69 (81.2%) participants in the experimental group had experienced web-enhanced learning (Yates’s $r = .24$, df = 1, $p = .63$).

Participants had experienced web-enhanced approaches in earlier courses; however, participants had remarked that their attitudes towards the use of the e-platform to
support their learning were influenced by their perception of the usefulness of the material. Participant E28 remarked “I would not read the uploaded materials in the e-platform except when the teacher reminded and required us to read the materials that could be followed by an exam in the coming week. I did not actively read the online materials until I found that there was a necessity for me to use the information. Alternatively, we were required by the teacher to execute searches and there was a need for me to use these materials to complete my next assignment. Otherwise, I did not use the information.” E28: 我都是有需要用到，老師說他 po 的資料，教我們回去讀，下禮拜要問或要考，我才會去看。然後我自己不會主動去看這些，除非說有需要用到，或是老師有跟我們講說要搜尋的地方，當面臨下一次要找報告的時候，想一下，才會再去把它拿起來用，不然平常的時候不會用到。

Another participant (E27) echoed this remark and commented that “I would not logon to (the) e-platform and read the materials until the last minute in order to complete my assignment.” E27: 我是要作報告的時後，才會上去看吧！

The participants admitted that they were passive towards the use of e-platforms. Participant E20 commented “I lacked motivation in my learning too. I would not use those materials at all if the teacher did not ask us to log on to the e-platform or if it would not be followed by a test.” E20: 我也是沒夠積極吧，如果老師沒有說要去網路上面 po 東西或是沒有說下禮拜要考試的話，我也是都不會去翻那些東西。She explained the low usage of the information on the e-platform might be due to the uselessness of the learning materials. “The usage rate of some extra online learning materials was quiet low. For example, previously, some information that had rarely been used was uploaded by the lecturer of (the) Patient Education Course and Professional Ethics Course. In fact, we did not log on to the platform and read the information.” E20: 有些是額外的教材，可是就是點閱率非常少，像之前衛教老師或是專業倫理的老師，有 po 一些平常不會用到的網路資源，其實我們都不會去看。

When the researcher queried what kinds of online learning materials were most attractive to them in terms of self-directed learning, several participants agreed that

24 Note: E: participants in the experimental group.
information related to them was most interesting. Testing information was one typical example that drove their online learning behaviour because the information would impact their academic scores. As participant E21 said “I must logon (to) the e-platform when the exam questions were posted in”. E21: po 题目的時候，就是一定會上去看。Participant E19 remarked that she also focused on the information that was related to (the) health problems of her relatives. She said “Family history, family diseases. If your grandfather or father had (a) certain disease and the relevant information was posted then I would pay attention to it.” E19: 家族史，家庭中的疾病呀! 假若，阿公和爸爸有的話，你就會很擔心，你會開始去收尋疾病的那些東西，對啊! 會去關注啦!

**Previous database learning experiences**

Prior database learning experiences were similarly assessed, including the participants’ use of both Chinese and English databases. Any differences in database learning experiences between the two groups might cause difficulty in examining the effects of the intervention. Again, a Chi-squared analysis was conducted to examine the independence of these two categorical variables. All underlying prior mentioned assumptions were checked and were met before this analysis. In addition Yates’s continuity correction was used in this analysis as previously described (Pallant, 2011).

The data showed that there was no statistically significant difference between the two groups of participants in their Chinese ($\chi^2 = 1.72, p = .190$) and English ($\chi^2 = 2.60, p = .107$) database learning experiences before the intervention. As shown in Table 14, which illustrates the results of the Chi-squared test, almost a quarter of the participants (27.4%) in the control group and one third of the participants (37.7%) in the experimental group had prior learning experiences of online searches via Chinese databases. Likewise, a higher percentage of students in both the control and experimental groups had no previous learning experiences in using English databases, with only 3 (4.1%) in the control group and 9 (13%) in the experimental group having any English database experience. In short, there was no statistically significant difference between the two participant groups’ database experiences.
The findings from the pre-test focus groups revealed that the participants had prior database learning experience. The students had been required to search academic databases during the semester prior to the current semester when the research was undertaken. “We were required to apply academic databases to our information searches during the Nursing Ethics Course in the previous semester. The assignments in the Nursing Ethics Course and Patient Education Course initially required us to do this, otherwise, we simply located information through general websites,” participant E3 commented. E3：上学期的倫理(三年級)才開始，就倫理、衛教那些報告才開始要求，不然之前都是用普通的搜尋網站。However, many of them mainly searched for information through the use of Google and Yahoo Search Engines.

Remarks from participants C25,18, C19 and C20 illustrate:
“C20: The problem was that we did not know anything about this matter (searches using academic databases).” C20:問題是我們什麼資訊都不曉得。 “C19: In particular, up till now, we knew only to locate information from Yahoo and Google search engines.” C19:尤其是到到目前為止，我們只知道要找資料要去 Yahoo 跟 Google。 “C18: We totally had no big picture concerning online searching.” C18:就完全沒有整個大方向。

To understand more in this regard, the participants who had been given instruction in academic database usage were asked to quantify the amount of instruction received and over what length of time. Also, qualitative data are described and were found to support the quantitative results.

25 Note: C: participants in the control group.
As Table 15 demonstrates, a short (less than 30 minutes) instruction was the most common length of instruction given to participants who reported having previous Chinese or English databases learning experiences. These data were analysed. A Chi-squared examination could not be performed because of the small number of responses in each cell. This would have resulted in an invalid statistical outcome. Almost an equal percentage distribution within each cell was found in both groups. For example, in relation to Chinese databases learning experience, a similar percentage of participants in the control group (50%) and the experimental group (57.7%) had received half an hour of learning experience; likewise, two out of three (66.7%) of the participants in the control group and seven out of 10 (70%) of the participants in the experimental group had previous English databases learning experience. In short, no extraordinary difference was found between the two groups through visual scrutiny.

<table>
<thead>
<tr>
<th>Chinese database instruction (hrs)</th>
<th>Control (n = 20)</th>
<th>Experimental (n = 26)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>.5</td>
<td>10 (50.0)</td>
<td>15 (57.7)</td>
</tr>
<tr>
<td>1</td>
<td>8 (40.0)</td>
<td>8 (30.8)</td>
</tr>
<tr>
<td>2</td>
<td>1 (5.0)</td>
<td>3 (11.5)</td>
</tr>
<tr>
<td>&gt;4</td>
<td>1 (5.0)</td>
<td>0 (0.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>English database instruction (hrs)</th>
<th>Control (n = 3)</th>
<th>Experimental (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
</tr>
<tr>
<td>.5</td>
<td>2 (66.7)</td>
<td>7 (70.0)</td>
</tr>
<tr>
<td>1</td>
<td>1 (33.3)</td>
<td>3 (30.0)</td>
</tr>
</tbody>
</table>

The participants complained that little information about how to search using academic databases had been given to them. This supported the quantitative findings, which revealed that less than 30 minutes of instruction was provided to a small minority of participants. The remarks from one participant illustrate the participants’ general dissatisfaction with their previous online searching education. Participant C13 said “I felt that the information given to us by the teachers from school was so limited; too little information had been given to us. We did not know how to correctly conduct searches. The teachers always questioned us as to why we could not locate the information needed. However, I want to emphasize that you (teachers) did not teach
us how to locate information. As a result, how could we find it? I felt that our information searching skills were limited. Almost all of us used the same website to retrieve information. Hence, our searching results were usually duplicated. The duplication rate was high. This was not because we did not want to search information but that we were given a lack of instruction. Instruction from the teacher did not elaborate. However, at the same time, we were asked to re-do our searches once the information used in our assignments was found to be the same as the other group.” C23:我只是覺得說學校給我們的資訊太少，教我們太少了。...我們都不知道要怎樣的搜尋，才是正確，老師常說你們怎麼都找不到，可是重點是你沒有教我們怎麼找，我們怎麼找到，我們搜尋的能力我真的覺得有限。差不多大家不管是誰，幾乎都是一個網站，然後一定會搜尋到重複的東西，重覆率真的很高的。然後也不是我們不找，只是老師教我們的太少，老師也沒有一直更新，只是一直說如果重複就叫我們一直重做。

**E-learning and searching competency**

The participants’ prior e-learning and online searching experience and their computer and the Internet (IT) competency were examined to assess any difference between the two participant groups before the intervention. It is assumed that participants with previous experience and higher IT literacy might demonstrate a higher e-learning performance. Ten five-point items concerning existing online learning and searching experiences and IT literacy of the participants were categorized as one variable, namely, e-learning and searching competency. The total score of this variable ranged from 10 to 50, with a higher score referring to a higher IT capability and more existing online learning and searching experiences. Please see Chapter 4, Methodology for more detail.

A two-sample t-test analysis was performed to check the equal variance of the two groups in this variable after the assumptions previously described were met. Both the total mean scores of the control and the experimental groups were normally distributed as indicated by the Kolmogorov-Smirnov test (p > .05).

The total mean scores of these 10 items were 33.97 (SD = 4.99) for the control group and 33.16 (SD = 5.91) for the experimental group. As the scale of results ranged from
10 to 50, the mean score of around 33 indicates a medium level of e-learning and searching competency. Table 16 illustrates the mean scores of individual and total items between the two groups and reveals that there was no significant difference in their total mean scores (t = .89, df = 140, p > .05) and individual mean (t= -.68 - 1.67, df = 140, p > .05). This indicates that there was no statistically significant difference relating to previous online learning and searching experiences or IT competency between the two groups.

Furthermore, Table 16 summarizes previous online learning experience (items 1 and 2), the Internet/computer technology capability (items 3-5), and information resources used (items 6-10) of the participants. Outcomes in relation to the individual items are summarized below:

- Item 1 indicates a high availability (mean = 4.10 - 3.96) of computer and the Internet access for e-learning;
- Item 2 shows a moderate frequency (mean = 3.42 - 3.32) for the participants to learn from the e-platform;
- Items 3-5 show that computer and the Internet competency of all participants was at a medium level, with a mean ranging from 3.39 to 3.68 (ranged from 1 to 5).
- Items 6-10 indicate a skewed phenomenon of all participants in their information seeking behaviour. Items 6, 8, and 9 were reported with a mean less than 3 (mean = 2.99 – 2.25) in the two groups. This indicated poorer skills (less experience) amongst the participants related to searching for information using the library catalogue (item 6) and academic databases (items 9 and 10). However, all participants reported a high frequency (stronger skills) (mean = 4.59-4.58) in using general searching engines, such as Google and Yahoo, for their searches.
Table 16. E-Learning and Searching Competencies of Participants

<table>
<thead>
<tr>
<th>Item (range from 1 to 5)</th>
<th>Control $(n = 73)$</th>
<th>Experimental $(n = 69)$</th>
<th>t</th>
<th>df</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Computer &amp; Internet access</td>
<td>4.10 (.87)</td>
<td>3.96 (1.05)</td>
<td>.87</td>
<td>140</td>
<td>.39</td>
</tr>
<tr>
<td>2. e-learning platform usage</td>
<td>3.32 (.94)</td>
<td>3.42 (.90)</td>
<td>-.68</td>
<td>140</td>
<td>.50</td>
</tr>
<tr>
<td>3. e-learning independency</td>
<td>3.68 (.93)</td>
<td>3.59 (1.01)</td>
<td>.56</td>
<td>140</td>
<td>.58</td>
</tr>
<tr>
<td>4. Computer skills competency</td>
<td>3.62 (.94)</td>
<td>3.52 (.87)</td>
<td>.64</td>
<td>140</td>
<td>.53</td>
</tr>
<tr>
<td>5. Internet skills competency</td>
<td>3.59 (.86)</td>
<td>3.39 (.83)</td>
<td>1.39</td>
<td>140</td>
<td>.17</td>
</tr>
<tr>
<td>6. Library catalog usage frequency</td>
<td>2.71 (.96)</td>
<td>2.57 (1.12)</td>
<td>.84</td>
<td>140</td>
<td>.40</td>
</tr>
<tr>
<td>7. General searching engine usage frequency</td>
<td>4.59 (.72)</td>
<td>4.58 (.63)</td>
<td>.08</td>
<td>140</td>
<td>.94</td>
</tr>
<tr>
<td>8. Academic website usage frequency</td>
<td>3.25 (1.05)</td>
<td>2.96 (1.02)</td>
<td>1.67</td>
<td>140</td>
<td>.10</td>
</tr>
<tr>
<td>9. Academic database usage frequency</td>
<td>2.25 (.95)</td>
<td>2.28 (1.11)</td>
<td>-.17</td>
<td>140</td>
<td>.87</td>
</tr>
<tr>
<td>10. Required to use academic database frequency</td>
<td>2.88 (1.13)</td>
<td>2.90 (1.14)</td>
<td>-.12</td>
<td>140</td>
<td>.91</td>
</tr>
<tr>
<td><strong>Total mean of 10 items (ranged from 10-50)</strong></td>
<td><strong>33.97 (4.99)</strong></td>
<td><strong>33.16 (5.91)</strong></td>
<td><strong>.89</strong></td>
<td>140</td>
<td><strong>.38</strong></td>
</tr>
</tbody>
</table>

Sig. 2-tailed, *P < .05.

The results of the qualitative data were similar to the findings from the quantitative data. When the researcher asked the participants about their prior online searching experiences, remarks from participant E25 validated the quantitative results.

Participant E25 replied in this way: “Sure! However, in general, I didn’t use such a professional and academic database.”E25：會啊！可是不會查的那麼專業、學術。

The participants were considered experienced in using general search engines to locate information but had limited experience in searching information through the use of academic databases.

With regard to information resources used by the participants, they were accustomed to locating information from textbooks, using the library in person, and utilising certain websites on the Internet. Participant C14 commented “Normally we were asked to find information from text books in the library (C14)” C14：都大概叫我們去圖書館找書。Participant C13 also commented “some teachers recommended to us to locate information from the Department of Health website and certain Nursing Association websites when we wanted to locate information related to nursing ethics.
“C13：有的老師，他會跟你說到衛生署的網站 (健康 99) 去那邊找，還有一些護理師公會的網站，去找一些跟倫理有關的資料。

In summary, no statistical differences in the background variables of the participants in the two groups were found before the intervention. These variables included gender, age, prior web-enhanced and database learning experiences, and e-learning and searching competency.

The majority of participants in the two groups were young females who had prior e-learning experience. However, few of them had database instruction experiences. This result contributed to the participants having limited information searching abilities/experiences in using library resources. As shown in Table 16, the low frequency use of academic databases for their searches is a typical example. Data revealed from the pre-test focus group discussions provided a cross validation for the quantitative data. Also, suggestions from and needs of the participants for their further information searching skills education, gathered from the focus group discussions, were integrated into the development of the intervention in the current research. The next section will address the results for each research question.

5.3 Results

This section presents the research results by research question for the five questions included in the current research. For each research question, the quantitative data were used to answer the question and the qualitative data were used to provide verification and additional insights.

5.4.1 Research question 1

What was the level of the ‘online search knowledge’ of the control group and the experimental group before and after the intervention period?

A 16-item test was used to measure the change in knowledge level of the participants concerning their online searches before and after the intervention period. Participants received one mark if they correctly answered the item but a nil score if an incorrect
answer was ticked. Scores for the test ranged from 0 to 16; the higher score indicating the higher knowledge level achieved.

A paired-samples t-test was used to compare the change in knowledge scores of the control and experimental groups before and after the intervention. Also, a paired-samples t-test was used to compare the means of the two groups before and after the intervention (Yockey, 2011). Before the analysis was undertaken, the underlying assumptions of the paired-samples t-test were examined; these include:

1. observations are independent within groups;
2. the difference scores are normally distributed in the population.

The sample had a nonnormal distribution; however, the sample size of 30 or more mitigates the violation of this assumption (Pallant, 2011). As a result, a paired-samples t-test was conducted for each group.

The results of the paired-samples t-tests are presented in Table 17, which depicts the mean knowledge scores of both groups of participants pre-test and post-test. The mean knowledge scores of participants in the control group were statistically significant, changing from 9.34 to 10.95 (t[72] = -6.47, p < .001); the mean knowledge scores of participants in the experimental group also were statistically significantly, increasing from 9.36 to 11.16 (t[68] = -6.59, p < .001). This indicates that both the usual instruction and the intervention were useful to participants in developing their knowledge regarding online searching.

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>T (df)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (range 0-16)</td>
<td>Mean (range 0-16)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>9.34</td>
<td>10.95</td>
<td>-6.00</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Experimental</td>
<td>9.36</td>
<td>11.16</td>
<td>-6.59</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Sig. (2 –tailed), *p < .0125 (due to the Bonferroni correction adjustment)

The data were further analyzed to establish if the participants’ knowledge increased across all items and aspects or if there were deficits remaining in some content areas.
The 16-item questionnaire consisted of five dimensions and each area of knowledge was measured. Example questions are provided in Table 18.

Table 18. Example Questions for Each Area of the Online Searching Knowledge Test

<table>
<thead>
<tr>
<th>No</th>
<th>Name</th>
<th>Item included</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>knowledge of database</td>
<td>1-3</td>
<td>Q1: Which approach is best for you to search information related to the statistics concerning the birth rate of newborns in Taiwan? A. Google engine B. Electronic Thesis &amp; Dissertations System C. the website of Department of Health, Executive Yuan, Taiwan.</td>
</tr>
<tr>
<td>2</td>
<td>knowledge of basic search</td>
<td>4-7</td>
<td>Q5: Which sentence below did not underline the main concepts (keywords) of the title? A. How to assist patients coping with the change of their body image after a colonostomy surgery? B. The self-care behaviour of diabetic patients C. The exploration of non-compliance behaviour of patients with hypertension</td>
</tr>
<tr>
<td>3</td>
<td>knowledge of advanced search</td>
<td>8-12</td>
<td>Q12: Of the following three options, which is the most efficient step for you to reduce the amount of information retrieved after you executed a search with “health care” as the search term and turned up 232 hits? A. added more keywords B. finding relevant article through title reading C. change search term to “health” and search again</td>
</tr>
<tr>
<td>4</td>
<td>knowledge of information resources</td>
<td>13 &amp; 14</td>
<td>Q14: Which will be best selection for you to carry out another online search when you cannot find enough information from Airiti Library? A. Google scholar B. Taiwan Journal Articles Image system C. Nationwide document delivery service (NDDS)</td>
</tr>
</tbody>
</table>

The total correct percentage of items in each dimension was analyzed using paired-samples t-tests to examining the difference within each group before and after the intervention period. All underlying assumptions previously described were checked and were met before the analysis.
The results of the paired-samples t-tests are presented in Table 19. This Table reveals that the knowledge of the participants in the control group reflected a statistically significant increase in areas 1 (knowledge of database) (t = -4.3, p < .001) and 2 (knowledge of basic search) (t = -2.8, p = .007). In the experimental group, there was a statistically significant increase in areas 1 (knowledge of database) (t = -5.7, p < .001) and 5 (knowledge of document type) (t = -6.0, p < .001). One point worthy of mention is that both groups of participants achieved the lowest increase in knowledge level in area 3 (knowledge of advanced search).

### Table 19. Knowledge Change of Participants

<table>
<thead>
<tr>
<th>Knowledge area (score range)</th>
<th>Control (n = 73)</th>
<th>Experimental (n = 69)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Before Mean (SD)</td>
<td>After Mean (SD) t (df) Sig</td>
</tr>
<tr>
<td>Area 1: database knowledge (0-3):</td>
<td>2.15 (.87)</td>
<td>2.62 (.57) -4.28** &lt;.001</td>
</tr>
<tr>
<td>Area 2: basic search (0-4):</td>
<td>3.05 (.88)</td>
<td>3.38 (.68) -2.77* .007</td>
</tr>
<tr>
<td>Area 3: advanced search (0-5):</td>
<td>1.25 (.81)</td>
<td>1.51 (.87) -2.25 .027</td>
</tr>
<tr>
<td>Area 4: information resources (0-2):</td>
<td>1.32 (.66)</td>
<td>1.52 (.58) -2.30 .024</td>
</tr>
<tr>
<td>Area 5: document type (0-2):</td>
<td>1.12 (.71)</td>
<td>1.37 (.68) -2.28 .026</td>
</tr>
</tbody>
</table>

The α level for this paired-t test was set at .01 due to the Bonferroni correction; * p < .01; ** p < .001

After the intervention period, focus group discussions were used to understand “how the participants described their knowledge via academic databases searches?” The qualitative data from the focus groups confirmed the findings from the quantitative analysis. The qualitative data provided important insights into the knowledge that the participants required and what they experienced during the learning process. In general, both groups increased their online searching knowledge in the area - using appropriate information resources and using suitable keywords to enhance the efficiency of searches. On the other hand, some weak areas concerning their online
searches were also reported, including the identification of search topics and keywords.

The awareness of using appropriate information resources
After the intervention phase, several participants responded that they understood the necessity for them to locate information from Ariti Library, a reliable information resource, instead of Google and Yahoo search engines. As earlier stated, many participants said they previously had ignored using suitable information resources for their academic writing and clinical practice. However, after the intervention period, they automatically chose Ariti Library as the information resource for their online searches. They cited articles from Ariti Library because it was a more reliable and an academic resource. As participants E20 and E23 said “I felt that information sought through Ariti Library was fairly professional and much more reliable than those from Yahoo and Google search engines (E20)”... “I felt that my searching skills are becoming more professional (E23)”. E20：因使用華藝後覺得較多專業文獻，也比奇摩，Google 的資料可信度來的高。E23：查東西變的有比較專業。

Understanding the efficiency of searches via suitable keywords
The analysis showed that many participants perceived the usefulness of using keywords. The efficiency of searches was enhanced using appropriate search terms because a great number of irrelevant information was excluded. According to the statement of participant E3, "keywords, it would become easier for our search... that is, the identification of keywords would enhance searching efficiency.” E3：關鍵字，比較容易，就是知道，大概關鍵字有哪些，這樣搜尋的會比較快。She further explained “for example, previously, we needed to search information related to physical, psychological and spiritual care for women with breast cancer. I started my search entering a whole sentence. But now, I was more likely to use “breast cancer” and “body image” as search terms. Therefore, the searching results were more comprehensive while filtering information at the same time. This would speed-up my browsing and searching of results and I efficiently obtained the information needed”, explained participant E3. E3：例如之前比說它不是乳癌婦女的，有什麼身心靈照顧，然後一開始都會整排字打下去，現在比較會分乳癌，第二項身體心像，找
Difficulties in the identification of search topics and keywords

The results also demonstrated that some participants experienced difficulty in identifying appropriate keywords. As a result, they admitted to the necessity of receiving further assistance from the lecturer/researcher to assist them in their search topics identification. Their search results were minimal or irrelevant when they independently executed searches without consulting the researcher/teacher, as indicated by the remarks of participant C1: “I could not find information or could only generate limited search results because I simply used keywords for my search and had little idea about the other search methods. Therefore, the findings came out “zero” or were very little” (C1). She further explained that “this outcome might have resulted from using incorrect keywords or not knowing how to identify keywords.” C7：就找不到文獻或是資料很少，因為只會用下關鍵字下去找，其它的方式沒很清楚，所以找的資料都是零筆或很少這樣子。可能是關鍵字錯誤或不知道怎麼去下關鍵字之類的吧！ Another participant C7 also remarked “I would think of retrieving information from Airiti Library whenever I needed to complete my assignment. However, I did not know how to select the information needed (relevant) after entering the keywords. That is, the retrieved article did not relate to the contents of my assignment. C7：在做報告時就會先想到用華藝去查，但在下關鍵字後查文獻卻不知怎麼抓文獻。就是，當找到一篇文獻卻與報告內容不符合。

In summary, the post intervention results indicated that both the control and experimental groups had a statistically significant increase in their overall online searching knowledge and database knowledge (area 1). The remarks of the participants from the post-test focus group discussions supported the quantitative data. A comparison of the difference in the post-test knowledge mean scores between the two groups will be discussed in Research Question 5.
5.4.2 Research question 2

What was the level of the ‘online search skills’ of the control group and the experimental group before and after the intervention period?

In order to understand the real online searching skills of the participants using academic databases, an authentic online searching test was used to measure the level of (pre-test) and change in (post-test) online searching skills of the participants. This test included two questions. Question 1 required the participants to locate and download an appointed article; there were four parts to this question. Question 2 was a scenario describing a woman with health problems, and seven assessment items were used to measure the skills of participants. The participants were asked to execute a search and to write down their searching strategies and numbers of search hits. One mark would be given to the participants if they performed a skill described in each item. Finally, the score was marked by an independent marker who was not involved in the current research project. The total score of the skills assessment ranged between 0 and 11: The higher the score the participant achieved, the greater their level of searching skills.

The data indicated that the participants in the two groups showed an increase in their post-test means related to online searching skills compared to their pre-test scores. After the intervention period, the mean scores of participants in the control group increased markedly from 4.12 to 7.22 and in the experimental group from 4.13 to 7.26.

The difference in the means of the individual groups before and after the intervention period was examined using a paired-samples t-test. Before analysis occurred the underlying assumptions described previously were checked. Although the assumption of the normal distribution of variables was violated, the analysis continued to be conducted for the reason previously described at Research Question 1 (Pallant, 2011).

As Table 20 depicts, a significant increase in the post-test online searching skills total mean scores was found both in the control group ($t[72] = -13.86$, $p < .001$) and in the experimental group ($t[68] = -15.02$, $p < .001$). This indicates that both the usual
instruction and the intervention enhanced the online searching skills of participants to some extent.

### Table 20. Mean of Online Searching Skills of Participants at Pre-test and Post-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test Mean (range 0-11)</th>
<th>Pre-test SD</th>
<th>Post-test Mean (range 0-11)</th>
<th>Post-test SD</th>
<th>t (df)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>4.11</td>
<td>1.88</td>
<td>7.22</td>
<td>.95</td>
<td>-13.85(72)*</td>
<td>&lt;.001</td>
</tr>
<tr>
<td>Experimental</td>
<td>4.10</td>
<td>1.60</td>
<td>7.23</td>
<td>.84</td>
<td>-15.02(68)*</td>
<td>&lt;.001</td>
</tr>
</tbody>
</table>

Sig. (2–tailed), *p < .0125 (due to the Bonferroni correction adjustment)

In order to understand which skills had or had not been used after the intervention period, a further analysis was performed using the percentage of skill performed by the participants in each assessment item. As revealed in Table 21, almost all assessment items in Question 1 showed a significant increase in both groups (t = -2.98 - -40.99, p < .001) or reached a 100% skill performed at items 1.1 and 1.2 in the control group, and at items 1.3 and 1.4 in the experimental group. In Question 2, the most common performed searching skills of the participants included the use of Boolean operators (item 2.4; t = 5.02 - 7.76, p < .001) and combined searching skills (item 2.2; t = 8.37 - 8.61, p < .001). However, the use of synonyms (item 2.3), fields and limits (item 2.5 and 2.6) were used less by the participants after the intervention period. This finding was congruent with the remarks of participants from the focus groups.
Table 21. Proportion of Individual Skill Performed by Participants at Pre-test and Post-test

<table>
<thead>
<tr>
<th>Item No</th>
<th>Control Group</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>Experimental Group</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-test</td>
<td>Post-test</td>
<td>t (df)</td>
<td>Sig.</td>
<td>Pre-test</td>
<td>Post-test</td>
<td>t (df)</td>
<td>Sig.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
<td>n (%)</td>
<td>n (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Question 1:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1</td>
<td>Academic database was used as information resources</td>
<td>44 (60.3)</td>
<td>73 (100.0)</td>
<td>-6.89 (72)**</td>
<td>&lt;.001</td>
<td>41 (59.4)</td>
<td>67 (97.1)</td>
<td>-5.74 (68)**</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Database with full-text was used.</td>
<td>44 (60.3)</td>
<td>73 (100.0)</td>
<td>-6.89 (72)**</td>
<td>&lt;.001</td>
<td>41 (59.4)</td>
<td>68 (98.6)</td>
<td>-6.24(68)**</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Fields were used (Ex: title, author, and journal was entered)</td>
<td>1 (1.4)</td>
<td>71 (97.3)</td>
<td>-40.99 (72)**</td>
<td>&lt;.001</td>
<td>0 (0.0)</td>
<td>69 (100.0)</td>
<td>@</td>
<td>@</td>
<td></td>
</tr>
<tr>
<td>1.4</td>
<td>The required article successfully downloaded</td>
<td>65 (89.0)</td>
<td>73 (100.0)</td>
<td>-2.98 (72)*</td>
<td>.004</td>
<td>66 (95.7)</td>
<td>69 (100.0)</td>
<td>-1.76 (68)</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>Question 2:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1</td>
<td>Use suitable keywords or phrases</td>
<td>67 (91.8)</td>
<td>73 (100.0)</td>
<td>-2.54 (72)</td>
<td>.013</td>
<td>66 (95.7)</td>
<td>69 (100.0)</td>
<td>-1.76 (68)</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>2.2</td>
<td>Advanced (combined) searcher was used</td>
<td>37 (50.7)</td>
<td>73 (100.0)</td>
<td>-8.37(72)**</td>
<td>&lt;.001</td>
<td>33 (47.8)</td>
<td>69 (100.0)</td>
<td>-8.61 (68)**</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>2.3</td>
<td>Synonyms were used</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>@</td>
<td>@</td>
<td>0 (0.0)</td>
<td>1 (1.4)</td>
<td>-1.00 (68)</td>
<td>.321</td>
<td></td>
</tr>
<tr>
<td>2.4</td>
<td>Boolean operators were used (two and more search terms were used)</td>
<td>25 (34.2)</td>
<td>50 (68.5)</td>
<td>-5.02(72)**</td>
<td>&lt;.001</td>
<td>16 (23.2)</td>
<td>52 (75.4)</td>
<td>-7.76 (68)**</td>
<td>&lt;.001</td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Fields were correctly used, such as title, abstract, and journal</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>@</td>
<td>@</td>
<td>0 (0.0)</td>
<td>0 (0.0)</td>
<td>@</td>
<td>@</td>
<td></td>
</tr>
<tr>
<td>2.6</td>
<td>Limits were used, such as type of document, publish year and area</td>
<td>1 (1.4)</td>
<td>8 (11.0)</td>
<td>-2.41 (72)</td>
<td>.019</td>
<td>0 (0.0)</td>
<td>11 (15.9)</td>
<td>-3.59 (68)*</td>
<td>.001</td>
<td></td>
</tr>
<tr>
<td>2.7</td>
<td>Number of search results was manageable (&lt;50)</td>
<td>16 (21.9)</td>
<td>35 (45.2)</td>
<td>-3.03 (72)*</td>
<td>.003</td>
<td>20 (29.0)</td>
<td>24 (34.8)</td>
<td>-4.5 (68)</td>
<td>.454</td>
<td></td>
</tr>
</tbody>
</table>

The α level for this paired-t test was set at .0045 due to the Bonferroni correction; * p < .0045; **p < .0009. @: The t cannot be computed because the standard error of the difference is 0.
The comments of the participants in both groups revealed that when they self-evaluated, they found an overall improvement in their searching skills. As participant E8 in the control group remarked, "I felt that I was improving and used it more often. It became quick (to find) the information needed because the use of Airiti Library allowed me to directly enter (the) author’s name and publication year (E8)." E8：我覺得我進步了，而且常使用，現在使用華藝比較快找到我需要的，例如直接打作者，年代。

Many participants expressed that they had become more skillful through repetitive exercises over time. After receiving the usual instruction, six to eight participants from each group in both the control and experimental cohorts were gathered into a small group, then worked together to complete their group assignments. The assignments included a literature review component, requiring the participants to locate at least 10 relevant articles. Thus, the participants had opportunities to conduct authentic online searching. The findings also indicated that experiential learning is a useful approach to improve the online searching skills of participants. The following describes the similar conclusions from two participants:

“Practice makes perfect. You achieved the skills if you did more practice. My progress was significant thanks to many assignments in this semester which produced frequent opportunities for me to use Airiti Library (E19).”E19：熟能生巧，多去碰它就是你的了。非常的有進步，這學期的報告特別的多，所以接觸華藝很頻繁。

“It became quicker while locating information because I repeatedly practiced what had been taught (E18).” E18：找尋資料的時候，速度變快了，老師上課教的方式有去反覆練習。

The analysis also found that the online searching skills of the participants also improved after the intervention period. Some of them applied certain searching tips into their searching strategy. Participant C3 in the control group agreed that her skills improved after the intervention period and said “My researching was improved compared with what I did in last semester. For example, I only knew how to search for information entering keywords, but after the instruction, I started to narrow my search scope by setting limits in published year and title of journal to reduce my
Another finding was that the participants were limited in certain areas of skills when conducting searches. Some students reported specific difficulties while using certain advanced skills, such as Boolean operators and truncation. The limitation noted by the participants was their inability to recall the tuition details. This slowed the students’ improvement. Participant C3 acknowledged the usefulness of using Boolean operators to enlarge or reduce her searching results after being given instruction. However, she encountered difficulties in employing more advanced skills into her searches because she forgot the teaching content, as she explained: “I intentionally tried using Boolean operators to obtain more results; however, I forgot the procedure because too much information was delivered at once. So, I could not use it.”

The data also revealed that certain searching skills would be ignored by the students if they self-evaluated that it was difficult for them to apply those skills. Most of the participants were used to locating information using Google search and entering phrases and keywords. In comparison with the use of keyword searching, truncation was new to them. This was illustrated by the comments of participant E18: “I was constrained in my time; I would read materials in the e-classroom from time to time, but not all of them. I only used materials that I thought were useful for me. I found it was difficult to use some searching method such as truncation. So I ignored it (E18).”

There was a statistically significant difference in participants’ post-test online searching skills scores between the control and experimental groups. The findings were reinforced by the remarks of the participants in the focus group discussions. Both quantitative and qualitative data indicated that the participants used a limited range of advanced searching skills. For example, some participants reported...
difficulties when they attempted to construct an effective search statement using Boolean operators to enlarge or narrow their search scopes. The differences in the post-test skills between the control and experimental groups are described in section 5.4.5, Research Question 5.

5.4.3 Research question 3

What was the level of the ‘online search self-efficacy’ of the control group and the experimental group before and after the intervention period?

The online searching self-efficacy of the participants was measured using the Online Searching Self-efficacy Inventory (OSSI) developed by Monoi, O'Hanlon, and Diaz (2005). Self-efficacy beliefs of each individual in specific area is an effective predictor of performance (Bandura, 1997). The instrument contained 12 questions, measured on a 10-point Likert scale. A higher score indicates a higher level of self-confidence.

In order to compare the level of online searching self-efficacy of participants they were measured at two points; a paired-samples t-test was used (Yockey, 2011). All underlying assumptions described previously were checked and found to be met (Pallant, 2011).

A comparison of mean scores of the self-efficacy of participants in both groups before and after the intervention period is described in Table 22. The mean score of the online searching self-efficacy of participants in the control group remained unchanged from the before (mean = 6.29, SD = 1.44) and after (mean = 6.29, SD = 1.41) the intervention phase. The mean score of the online searching self-efficacy of the experimental group increased from 6.05 (SD = 1.42) to 6.64 (SD = 1.41) after the given intervention. This change was statistically significant: t (68) = -3.33, p = .001. This indicates that the intervention may enhance the level of online searching self-efficacy beliefs of participants; conversely, the usual instruction did not assist participants to augment their online searching confidence levels.
Table 22. Mean Scores of Self-Efficacy of Participants at Pre-test and Post-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th></th>
<th>Post-test</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Control</td>
<td>6.29</td>
<td>1.44</td>
<td>6.29</td>
<td>1.41</td>
</tr>
<tr>
<td>Experimental</td>
<td>6.05</td>
<td>1.42</td>
<td>6.64</td>
<td>1.41</td>
</tr>
</tbody>
</table>

T (df)  | P value |
--------|---------|
-0.06(72)| .954    |
-3.33(69)| .001*   |

Sig. (two-tailed) *p ≤ .001.

The remarks of the participants in the experimental group illustrate the increase in their confidence regarding online searches using academic databases. One participant had little experience using Airiti Library to search for information before the intervention, but had become more confident using the database to locate information after the intervention period. As she described “Now I believed it was quick and accurate (searching information via Airiti Library). Before, I spent a much longer time to locate the information needed (E12).” E12: 我覺得現在是快速準確。之前要找很久。This was reinforced by participant E3 as she self-evaluated her searching skills and said “I felt that my searching ability was improved because I used keywords to conduct searches and I became quicker in identifying keywords. Also, the information searching yields were complete and not too many.” E3：自覺自己的搜尋能力進步，我使用關鍵字查詢，而且下關鍵字變快速，找到的資料完整且不會太多等。

The findings also demonstrated that the confidence of learners was strengthened when they successfully located relevant information. Improvement in information searching knowledge and skills enabled the participants to be more efficient in their information searches. The higher the online search efficiency level they reached the less distress they experienced; and, as a result, their online searching confidence increased. The remarks of participant E2 illustrate that her confidence was strengthened through the successful searching experience: “It (the use of Airiti Library) led to no fear or anxiety while doing academic assignments. Also, it enabled me to make decisions more precisely and locate the information needed more efficiently.” E2：使我面對專業報告不會害怕或恐懼，也更快速的找到自己需要資料，也更準確下判斷。
In summary, only participants in the experimental group showed a statistically significant increase in their online searching self-efficacy scores after the intervention. At the same time, remarks of the participants provided supportive evidence to verify the quantitative findings. There were no statistically significant findings from the pre-test and post-test scores of online searching self-efficacy of participants in the control group who received the usual face-to-face instruction. The difference between the two groups after the intervention period will be discussed in section 5.4.5.

5.4.4 Research question 4
What was the level of the self-directed learning readiness of the control group and the experimental group before and after the intervention period?

In order to understand the change in self-directed learning readiness of the participants after the intervention based on principles of adult learning and problem-based learning approaches, the Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) by Fisher, King, and Tague (2001) was used to measure participants’ level of self-directed learning readiness. This 40-item five-point Likert instrument consists of three factors/subscales:

- Factor 1: Self-management, scores range from 13 to 85 (13 items),
- Factor 2: Desire for learning, scores range from 12 to 60 (12 items), and
- Factor 3: Characteristics of self-control, scores range from 15 to 75 (15 items).

Four items (3, 22, 30, and 40) are negatively described; therefore, the scores of these items were reversed while entering the data.

The total score for this scale ranges between 40 and 200; a higher participant score denotes a higher level of perception of independent learning. The total mean score of participants in the experimental group increased from 143.80 to 145.39 after the intervention. The total mean score of the participants in the control group declined slightly from 144.30 to 144.26 across two data collection points. The total SDLRSNE scores of the participants seemed to be lower compared to results from previous research: Five studies reported that the overall SDLRSNE score of bachelor degree nursing students ranged from 150.55 to 160.14 (Fisher et al., 2001; KaoYu-Hsiu 高毓
The results of the paired-samples t-tests for the two groups in their total SDLRSNE scores and the three subscale total mean scores are shown in Table 23. No significant changes were found either in the control group (t[72] = -.03, p = .98) or in the experimental group (t[68] = -.95, p = .35).

### Table 23. Means of SDLRSNE between the Control and Experimental Groups at Pre-test and Post-test

<table>
<thead>
<tr>
<th>Group</th>
<th>Name of scale</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>t (df)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Control</td>
<td>Total scale</td>
<td>144.30</td>
<td>18.10</td>
<td>144.26</td>
<td>18.40</td>
</tr>
<tr>
<td>Factor 1: Self-management</td>
<td>44.77</td>
<td>5.72</td>
<td>44.79</td>
<td>6.28</td>
<td>-.05 (72)</td>
</tr>
<tr>
<td>Factor 2: Desire for learning</td>
<td>44.74</td>
<td>6.29</td>
<td>44.99</td>
<td>5.99</td>
<td>-.42 (72)</td>
</tr>
<tr>
<td>Factor 3: Self-control</td>
<td>54.79</td>
<td>8.05</td>
<td>54.48</td>
<td>7.43</td>
<td>.38 (72)</td>
</tr>
<tr>
<td>Experimental</td>
<td>Total scale</td>
<td>143.80</td>
<td>18.55</td>
<td>145.39</td>
<td>17.00</td>
</tr>
<tr>
<td>Factor 1: Self-management</td>
<td>44.51</td>
<td>6.47</td>
<td>45.38</td>
<td>5.70</td>
<td>-1.44 (68)</td>
</tr>
<tr>
<td>Factor 2: Desire for learning</td>
<td>44.29</td>
<td>6.15</td>
<td>45.43</td>
<td>5.70</td>
<td>-1.80 (68)</td>
</tr>
<tr>
<td>Factor 3: Self-control</td>
<td>55.00</td>
<td>7.52</td>
<td>54.58</td>
<td>7.14</td>
<td>-.54 (68)</td>
</tr>
</tbody>
</table>

In order to understand the change in the scores of participants across the three factors, a further comparison between the two groups using the total mean scores of the three subscales was performed. The total means of the three subscales in the two groups increased slightly except for Factor 3: Self-control, and no significant findings are reported (Table 23). It is worth mentioning that the total mean of the Factor 3 subscale decreased slightly after the intervention phase but this was not a statistically significant difference. In the control group, the total mean score in Factor 3 decreased from 54.79 to 54.48 (-.31); a minor decrease was also found in the experimental group from 55.0 to 54.58 (-.02). Although no statistically significant improvement was found, the focus group discussions revealed that certain self-directed learning behaviours were encouraged through the use of educational approaches.

The qualitative data analysis addressing the self-directed learning readiness of the control and experimental groups was different. No score change was found in the control group between the pre-test and post-test. Therefore, only comments from the
participants in the experimental group are described. They were asked to illustrate
what they experienced differently between the intervention and their prior learning
experience.

The analysis found that the intervention might affect the manner of self-management
of the participants. The intervention aimed to create a supportive environment. Take
the use of the e-classroom as an example. The e-classroom is an alternative learning
approach that has fewer limitations in time and geography. With the awareness of
what they can learn, students can flexibly reach learning support when the need arises.
As one participant (E15) perceived, her attitude toward studying was different from
previously during the intervention period. “My previous learning attitude was – Oh! I
have no time, so I do not want to do anything. However, through this learning
experience, I would like to be more proactive in my study and thus have expanded my
learning ability…. I was constrained in my time to have a discussion with my team
members; however, I would like to know and learn what is new for me from the e-
classroom to improve myself when I am free from classes in the morning at
school.” E15:自己的心態吧！經由這次的話，在學習態度上以前都是-哈^沒時間
不想去什麼的，經過這幾次的方式呀^就會比較想去以積極的心態去學習它來擴
充學習的能力…. E15:我比較沒有時間跟同學去討論什麼的，但如果在學校讀書
的時間，早上有在學校的時間剛好會有空堂，剛好有這時間比較會想要去知道
說這次(網路學園)又要教什麼呀！我又可以學到新的東西新的知識，就是補充
自己。

The results also revealed that the self-directed learning readiness of the participants
was encouraged through the intervention. An asynchronous online group discussion
board was included in the intervention. This forum enabled participants to contribute
their effort and mutual help when working in a group work setting. Through the cyclic
discussions, the participants became more accountable and engaged in their group
work. Participant E24 described the impact on her through the intervention as “I
passively followed (the) instruction of the team leader and completed my own portion
of the work. Yet, now, I perceived the importance of this assignment; therefore, I
thought that I should make more effort towards perfecting this assignment besides the
appointed work that I needed to do. (E24)” She further commented “This time, I was
so responsible because we were doing the same work using the online group
discussions. I would think to help other group members; although I had fulfilled my
own duty I might try to add more information, aiming to perfect my work.”

In summary, the quantitative results from participants in both groups did not reveal a
statistically significant increase in their post-test SDLRSNE total mean scores or the
three subscales. The qualitative data, to some extent, revealed that their readiness to
be independent learners was motivated after experiencing the intervention. The
difference in the SDLRSNE between the two groups of participants will be addressed
in the next section.

5.4.5 Research question 5

What was the effect of an educational intervention on the online search
knowledge, skills, self-efficacy, and self-directed learning readiness of ADN
students in the intervention cohort compared to ADN students who received
usual instruction?

The focus of Research Question 5 was a comparison of the online searching
knowledge, skills, self-efficacy, and self-directed learning readiness of the
participants in the control and experimental groups after the intervention. Quantitative
data were used to answer the question; qualitative data provided additional insights.
The information collected from the focus group discussions focused on what the
participants in the control and experimental groups experienced differently during the
period between the pre-test and the post-test.

Initially, an independent-samples t-test was employed to compare these four
continuous outcome variables between the two groups of participants. All underlying
assumptions previously addressed were checked and found to be met before performance of the analysis.

Table 24 shows that all outcome measures of the participants in the experimental group were higher than those of participants in the control group in the post-test; however, the results did not reveal a statistically significant difference. This denotes that the intervention did not make a significant difference, when compared with the usual instruction, to the improvement in knowledge, skills, self-efficacy, and SDLRSNE of participants.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control (n = 73)</th>
<th>Experimental (n = 69)</th>
<th>P value (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (range)</td>
<td>SD</td>
<td>Mean (range)</td>
</tr>
<tr>
<td>Knowledge</td>
<td>10.95 (0-16)</td>
<td>1.86</td>
<td>11.16 (0-16)</td>
</tr>
<tr>
<td>Skills</td>
<td>7.22 (0-11)</td>
<td>9.50</td>
<td>7.23 (0-11)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>6.30 (1-10)</td>
<td>1.41</td>
<td>6.64 (1-10)</td>
</tr>
<tr>
<td>SDLRSNE</td>
<td>144.26 (40-200)</td>
<td>18.40</td>
<td>145.39 (40-200)</td>
</tr>
<tr>
<td>Factor1</td>
<td>44.79 (13-65)</td>
<td>6.28</td>
<td>45.38 (13-65)</td>
</tr>
<tr>
<td>Factor2</td>
<td>44.99 (12-60)</td>
<td>6.00</td>
<td>45.43 (12-60)</td>
</tr>
<tr>
<td>Factor3</td>
<td>54.48 (15-75)</td>
<td>7.43</td>
<td>54.58 (15-75)</td>
</tr>
</tbody>
</table>

A multivariate analysis of covariance (MANCOVA) analysis was performed to analyze the effectiveness of the two different teaching approaches after controlling the influence of extraneous variables. MANCOVA is an extension of analysis of covariance when a research issue has more than one dependent variable. The use of MANCOVA can avoid the problem of ignoring a relationship between dependent variables (a risk with ANCOVA) (Field, 2009). Table 25 describes a moderate relationship amongst the four outcome/dependent variables in the research. In addition, four pre-test scores of participants in knowledge, skills, self-efficacy, and self-directed learning readiness were used as covariates to control any pre-existing difference.
Table 25. Correlation Coefficients amongst the Four Post-test Outcome Measures

<table>
<thead>
<tr>
<th>Variables</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Self-efficacy</th>
<th>SDLRSNE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge</td>
<td>1.00</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skills</td>
<td>.25**</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>.35**</td>
<td>.17*</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>SDLRSNE</td>
<td>.17*</td>
<td>.18*</td>
<td>.57**</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Sig. (2-tailed), * p < .05; ** p < .001. N = 142

Before this analysis, all assumptions underlying a MANCOVA analysis were checked and were found to have been met. These assumptions include those for normal multivariate analysis of variance (MANOVA) analysis and additional ANCOVA assumptions:

1. Covariate is measured before the intervention;
2. Covariates are not strongly correlated with one another;
3. Homogeneity of variance of covariates;
4. Linearity - the relationship between the dependent variable and the covariate for all groups;
5. Homogeneity of regression slopes - the relationship between the covariates and the dependent variables is the same for each of the groups; that is, the slopes are equal for all cells (there is no interaction between independent variables and covariates) (Pallant, 2011; Tabachnick & Fidell., 2007).

Preliminary checks were conducted to ensure that there was no violation of the assumptions of homogeneity of variances, linearity, and homogeneity of regression slopes. The equality of variances was found to be satisfied by examining the distribution graph and Levene’s test (F[1, 140] = .09 - .90, p > .05). Each covariate did not show a strong correlation with its dependent variable (r = .28 - .70). The relationship of the covariates and dependent variables in each group was found to be linear by way of scatterplots. Finally, interaction between the independent variable (group) and the covariates (four pre-test means) was found to be of no significance through a homogeneity of regression test by SPSS general linear model of multivariable analysis with F(1, 132) = .03 - .52, p > .05. (p = .473 - .86). Finally, the dependent variables are equal across groups with Box’s M test, F(10, 93017.723) =
1.06, \( p = .393 \). A further description of the statistical results is addressed in the section below.

5.4.5.1 Knowledge differences between the two groups

The quantitative data analysis addressing the difference in the online searching knowledge of the control and experimental groups after the intervention is presented in Table 26. The covariate pre-test knowledge mean scores was significantly related to the post-test knowledge mean scores of the participants (\( F[1, 136] = 17.31, p < .001 \), partial \( \eta^2 = .113 \)). This indicates that the post-test knowledge scores of the participants can be explained 11.3% of variance by the pre-test knowledge scores (covariate).

When examined, the effect of the independent variable was not statistically significantly different in the post-test knowledge mean scores of the control or intervention participants after controlling for the effect of the pre-test knowledge mean scores (\( F[1, 136] = .54, p = .464 \), partial \( \eta^2 = .004 \)). This indicates that the variance of the post-test knowledge score explained by the group (independent variable) did not have statistical meaning because of a very small effect size (partial \( \eta_2 = .004 \)); that is, the group difference of the participants can explain only 0.04% of variance of their post-test mean knowledge score.
Table 26. MANCOVA of the Post-test Outcome Variables between the Two Groups

<table>
<thead>
<tr>
<th>Variable</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig.</th>
<th>Partial η²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corrected Model</td>
<td>88.41</td>
<td>5</td>
<td>17.68</td>
<td>4.91***</td>
<td>&lt;.001</td>
<td>.153</td>
</tr>
<tr>
<td>Intercept</td>
<td>71.64</td>
<td>1</td>
<td>71.64</td>
<td>19.87***</td>
<td>&lt;.001</td>
<td>.127</td>
</tr>
<tr>
<td>Post-test Knowledge</td>
<td>62.39</td>
<td>1</td>
<td>62.40</td>
<td>17.31***</td>
<td>&lt;.001</td>
<td>.113</td>
</tr>
<tr>
<td>Pre-test Knowledge</td>
<td>1.94</td>
<td>1</td>
<td>1.94</td>
<td>.54</td>
<td>.464</td>
<td>.004</td>
</tr>
<tr>
<td>Group</td>
<td>490.25</td>
<td>136</td>
<td>3.61</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Error</td>
<td>17915.00</td>
<td>142</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>578.66</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>17915.00</td>
<td>142</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test Skills</td>
<td>15.21</td>
<td>5</td>
<td>3.04</td>
<td>4.24***</td>
<td>.001</td>
<td>.135</td>
</tr>
<tr>
<td>Pre-test Skills</td>
<td>35.53</td>
<td>1</td>
<td>35.53</td>
<td>49.51***</td>
<td>.000</td>
<td>.267</td>
</tr>
<tr>
<td>Group</td>
<td>.31</td>
<td>1</td>
<td>.31</td>
<td>.43</td>
<td>.512</td>
<td>.003</td>
</tr>
<tr>
<td>Error</td>
<td>97.58</td>
<td>136</td>
<td>.72</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Total</td>
<td>7526.00</td>
<td>142</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Corrected Total</td>
<td>578.66</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test Self-efficacy</td>
<td>31.32</td>
<td>1</td>
<td>31.32</td>
<td>21.67***</td>
<td>&lt;.001</td>
<td>.137</td>
</tr>
<tr>
<td>Pre-test Self-efficacy</td>
<td>6.95</td>
<td>1</td>
<td>6.95</td>
<td>4.81*</td>
<td>.030</td>
<td>.034</td>
</tr>
<tr>
<td>Group</td>
<td>196.60</td>
<td>136</td>
<td>1.45</td>
<td></td>
<td></td>
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<tr>
<td>Error</td>
<td>6211.78</td>
<td>142</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>578.66</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>6211.78</td>
<td>142</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Post-test SDLRSNE</td>
<td>21610.92</td>
<td>5</td>
<td>4322.18</td>
<td>26.18***</td>
<td>&lt;.001</td>
<td>.490</td>
</tr>
<tr>
<td>Pre-test SDLRSNE</td>
<td>3699.03</td>
<td>1</td>
<td>3699.03</td>
<td>22.41***</td>
<td>&lt;.001</td>
<td>.141</td>
</tr>
<tr>
<td>SDLRSNE Group</td>
<td>15962.19</td>
<td>1</td>
<td>15962.19</td>
<td>96.69***</td>
<td>&lt;.001</td>
<td>.416</td>
</tr>
<tr>
<td>Error</td>
<td>68.74</td>
<td>1</td>
<td>68.74</td>
<td>.42</td>
<td>.520</td>
<td>.003</td>
</tr>
<tr>
<td>Total</td>
<td>3021787.00</td>
<td>142</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Corrected Total</td>
<td>578.66</td>
<td>141</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sig. (2-tailed), * p < .05; **p < .01; ***p < .001.

Figure 8 describes the post-test knowledge mean score, having controlled for the influence of the pre-intervention levels of knowledge. The original post-test knowledge mean core was replaced by the estimated marginal means of knowledge. A significant increasing slope is presented in Figure 8, as previously discussed in the paired-samples t-test analysis (Table 17). Also, a visible gap exists between the two slope lines; this demonstrates a marginal difference between the two groups.

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Therefore, effective size and power were calculated for the online searching knowledge of participants as a core analysis for this research, which showed an interesting but not statistically significant difference.

The effect size for the analysis of the knowledge was a partial \( \eta^2 \) at .004, which is less than a small effect (.01) (Pallant, 2011). Post-hoc calculations were performed on the sample size required to achieve a power of .8 for the test of the difference of two means with \( \alpha = .05 \), and more than 1500 participants per group as a sample size were required (Polit & Beck, 2012) ; however, this was not a feasible/possible sample size for this study. It might be this small effect indicating a nonstatistically significant result between the two groups.

The qualitative data analysis results indicated that the two groups of participants had contrasting experiences after receiving different educational approaches. The participants in the experimental group reported that the intervention provided adequate resources that supported their increase in knowledge compared to the usual face-to-face instruction.

The analysis showed that participants in the two groups had different experiences in accessing academic support which assisted them to gain knowledge. Participants in both groups responded that they could not remember the entire body of information given them all at once by the librarian. They agreed that they needed more support to assist their further learning. Usually, in a traditional educational approach, peer group support and the teacher are two available resources. Participant C16 said: “For instance, teacher X gave us such (a) huge amount of information that I could not
remember. I needed to ask assistance from peers or return to the teacher and ask.” C1: 有時候，像 X 老師這樣一次帶過，我一次沒辦法記這麼多。我就需要同學幫忙或是再去問老師。However, the teacher was not always accessible and the students might remain puzzled after peer discussions. Hence, several participants expressed that they needed further online searching skills education. The remarks of participant C1 in the control group also illustrate the effects of overload of information given during instruction. “Yes, I want to learn. But it was so quickly presented that I could not accept and take in such a huge amount of information (C1).” C1：對呀！想學，但講太快沒辦法，吸收這這麼多一次突然教這麼多然後，好像也沒辦法吸收進去這樣子。She added that more teaching hours should be included in their online searching skills instruction. “I felt online searching instruction should be given as one course work. So many search methods were given in such a short period of time. We were overloaded. I felt somewhat confused when selecting the tips for my research (C1).” She further explained “for example, the use of AND and OR still confused me concerning their covering range for the searching results. I did not feel competent using it (C1).” C1：就感覺應該可以開一門課了，短短時間，一下子突然要學那麼多搜尋的方法，然後我們就太多了，就不知道抓哪個搜尋我們要的資料，對呀就有一點模糊。...就用很多英文字 and/or，還是有一點不太清楚。就是它的範圍啦！不太會使用。

In contrast to the experiences of participants who received the usual teaching instruction, participants in the experimental group reported the usefulness of technology-enhanced learning. This approach provided a variety of learning resources and also flexible access to those resources to support their learning. Students in the experimental group also acknowledged that they could not recall, afterwards, the details of the information given to them by the librarian. Yet, the use of the e-platform provided them with some useful materials, which were available to them when they had a need for them. A positive evaluation concerning the use of web-enhanced education was reported by the participants. Participant E2 said “it helped us to strengthen our memory through the use of those online materials and we could review it in case we had forgotten it. (E2).” E2：那些輔助學習可以幫助我們加深記憶，若忘了還可以回頭去瞭解。Also, the use of self-paced online learning materials
might broaden the learning horizon of the students as participant E8 in the experimental group commented: “I extended my searching knowledge from Google search to Google Scholar after watching the video provided in the e-classrooms.” E8

敏：原本就是 Google 我以為只可以查一般的東西，阿那有一個學術類的可以去用，是因為老師網路學園上面有擺那個影音式的資料才知道，對有延伸到！

The comments from the two groups of participants demonstrated that knowledge of information searches cannot be directly transferred to students using handouts alone. After being given instructions, the participants needed further support to assist them to gain knowledge. Participants found the web-enhanced approach adequately provided resources to meet their learning needs and helped them gain knowledge.

Another finding was that a web-enhanced approach provided more student-teacher interactions, which facilitated knowledge acquisition. Participants in both groups were required to complete a group assignment. It was assumed that each student would learn through the collaborative work and discussions. Discussion is encouraged as a deep learning strategy which enables learners to gain knowledge through reasoning. A facilitator, who is more experienced than the group members, is necessary when using group discussion as a teaching strategy. However, traditional teaching was found to be limited in providing adequate teacher immediacy while the participants were in discussion groups. As a result, learning could be discouraged if no further support was available. Participant E15 said “I believed that discussions amongst group members would only lead to disorientation in information searches. The discussion with the teacher/researcher would enable us to know how to approach the health problems of our case and conduct the searches. We had better orientation towards our work and (could) search for our targets after the discussion (E15 from the experimental group).”

E15：因為我覺得因為如果是同學之間討論，會不知道怎麼去找方向。跟老師討論完之後就會知道我們針對這個整個案的問題然後怎麼去下筆，我們該如何去找。跟老師討論之後，才知道怎麼去用怎麼樣的方式去搜尋我們要的答案，對呀之前都不知道該怎麼去去呈現。A web-enhanced approach created a learning environment in which the participants had more flexibility to interact with the researcher (as a facilitator). The following are remarks of participant E1 when she evaluated the use of the online forum in the current research. “More convenience, I
thought. For example, previously we needed to make an appointment before any discussion with teachers; however, sometimes, the teacher was not available. But, now, we conducted online discussions and you (the researcher) were also involved and, therefore, you could give us prompt feedback concerning what we had discussed in the online forum.” EJ:比較方便吧！就是以前討論的話，就是如果沒有討論室的話，就是要跟老師約時間，不一定老師會有時間討論。現在就是，我們在線上討論室討論，妳也看得到，妳就可以直接幫我們回答我們討論室討論出來的東西。

In summary, no significant differences were found between the two groups of participants in the post-test knowledge scores. However, from the focus group discussions, participants in the experimental group reported that a web-enhanced approach provided more resources conducive to their learning, such as useful online materials and more teacher-learner interactions. Also, a positive evaluation towards the online searching skills education was found in the experimental group. In contrast, participants in the control group were not satisfied with the usual face-to-face instruction; and, hence, they strongly suggested further online searches instruction.

5.4.5.2 Skills differences between the two groups

The MANCOVA statistics revealed a non statistically significant relationship between the covariate, the pre-test skills total mean scores, and the post-test skills total means, $F = .43$, $p = .512$, partial $\eta^2 = .003$. This means that the pre-test skills total mean scores of participants can only explained $0.3\%$ of variance of the post-test skills total scores.

Table 26 presents the effect of group differences on the post-test skills total means of participants between the control and experimental groups. There was no statistically significant difference after adjusting for the pre-test skills total means ($F [1, 136] = .05$, $p = .829$). Also, almost no effect size ($<.001$) was found. This means that an extremely small amount of variance of the post-test skills total means of participants was explained by the difference of groups (independent variable).
Figure 9 describes the post-test skills score, having controlled for the confounding influence from the pre-intervention levels of skills. The original post-test skills score was replaced by the estimated marginal means of skills. The outcomes from both groups are demonstrated through an increased slope as shown in Figure 9, as in the paired-samples t-test analysis discussed previously (Table 19). However, there is no distinguishable marginal difference between the two groups. There was no divergent finding between the Figure and the previous statistical analysis. On the other hand, qualitative data provide a different perspective and aids understanding of how the participants mastered their searching skills and how many opportunities were provided to the participants to develop skill mastery using the two different teaching approaches.

![Figure 9. Skills Total Means before and after the Intervention with Estimated Marginal Means for Post-test](image)

**How the participants achieved improved skills**

The analysis revealed that practice was the key to participants achieving improved online searching skills. Thus, an appropriate *teaching approach should allow the learners to accumulate their learning experiences*. However, it was found that traditional instruction, a content-focused teaching approach, was less likely to encourage learners to practise. It was also found that adequate specific knowledge is a prerequisite for learners to become skilled.

Almost all the participants agreed that more practice, that is, the accumulation of experiences, contributed to the improvement of their online searching skills. Participants in the control group complained that the given traditional instruction did not provide them with enough authentic examples and “hands on” exercises: So they were overwhelmed and confused after the instruction. Participant C6 commented
“from my point of view we needed to receive one more class of information searching instruction. Also, it would give us a clearer mind if some computer hands on activities were provided. Our understanding would be improved through practical application. (C6).” C6：我是覺得可以再多一節資訊收尋的那節課，就那一次上課而已呀！我覺得可以再多一些。用電腦教學，可讓我們更清楚一點，我覺得，因為我覺得操作對我們而言，比較好理解。In addition, participant C2 expressed, “It would impress us more if practical exercise was followed by oral instruction (C2).” C2：我們就是他講完，我們馬上做，會印象會比較深刻，實際操作就是會比口頭上講來的清楚。

The analysis showed that traditional instruction is an inadequate method to teach online searching skills if it is not integrated with other strategies that provide further practice opportunities for learners. Several authentic examples of information searches were demonstrated to the participants during the usual instruction and some hands-on exercises followed. However, several participants were not satisfied with the learning experience and they complained that their searching skills did not improve due to their inability to recall the searching procedure presented in the class. As another participant explained: “I intentionally tried using Boolean operators to obtain more results; however, I forgot the procedure because too much information was delivered at once. So, I could not use it (C3).” C3：就是想要試看看用布林查詢，看能不能查到得比較多，然後因為都忘記那個步驟，因為資訊太多都吸收不了，所以都不會。The remarks of C3 can explain why several participants in the control group expressed that they needed more online searching education. This is in contrast to participants in the experimental group who received further support through the use of self-paced online materials. They appreciated those self-paced online materials which provided them with timely information. Participant E10 remarked “I felt it was great because we could log on to the e-classroom to review whatever we did not understand from the class.” E10：我覺得這樣子很好，因為假如我們上課聽不懂，網路資料上面還可以看。Participant E19 echoed that opinion and said “There was a great advantage in integrating e-learning with our education. Much information regarding how to conduct online searches was included (E19). E19：網路教學的助益非常之大，裡頭有很多教我們如何搜尋的資料。”
The findings demonstrated the importance of practical learning experience in achieving improved skills. However, do all teaching strategies create a learning environment that produces opportunities for students to master their skills? Some participants described that their online searching practices/skills depended on what role they played in the group work. For example, if a particular person was not assigned to conduct the search then that person had fewer opportunities to practise those skills. As participant C16 revealed “Some looked for information and some did the writing part. As a result, everyone would become more proficient in their own areas. However, those who did the writing part did not have real information searching experiences. I thought it was better for everyone to exercise once in information searching while completing their assignment.” C16：(分組作業分工時)有些人就是找資料的，有一些人是做的，就變成在做作業的人他那一部分比較強，可是他在找資料時候就沒辦法真的去實際操作，我覺得作報告話，應該每一個人都應該練習一次。

It is expected that all nursing graduates are competent in online searching because these skills are an essential component in practising evidence-based nursing and lifelong learning. A project-/problem-based group work teaching strategy aims to enhance the collaboration of learners through real world case study. Indeed, when given a group work learning strategy without adequate teacher immediacy, each student simply contributed to and gained mastery of that part being assigned. However, the intervention, which integrated adequate feedback from the researcher, created a learning environment that facilitated learners contributing their effort in a group learning setting. Participant E22, who received the intervention, commented “It was true. Each member learnt something; everyone fully participated in the discussion and searched for information (E22).” E22：真的呀！每個人都學習到什麼，大家都在討論，都很投入，大家都找資料耶。

In summary, no significant difference in the post-test skills scores was found between the two groups. The qualitative data did not attempt to describe what different levels of skills they reached but what differences they experienced while mastering the skills. The results showed that practice was the most significant factor contributing to their online searching skills improvement. The participants reported that learning
effectiveness was limited when they received a content-centred instruction that did not provide a learning environment that encouraged further practice. On the other hand, participants who received a web-enhanced approach informed by KALT demonstrated that they were encouraged to conduct online searches.

5.4.5.3 **Self-efficacy differences between the two groups**

In relation to the difference in self-efficacy between the two groups, as illustrated in Table 26 above, there was a statistically significant relationship between the covariate, the pre-test self-efficacy mean, and the post-test self-efficacy mean score of the participants (F = 21.67, p < .001, partial eta squared = .137). This indicates that the post-test self-efficacy means of the participants (dependent variable) can be explained by their pre-test self-efficacy mean scores at 13.7% of variance.

After adjusting for the pre-test self-efficacy mean scores of the participants, there was a statistically significant difference in the post-test self-efficacy estimated marginal means of participants between the control and experimental groups, at F(1, 136) = 4.81, p = .030, and with partial eta squared at .034 (Table 26 above). This means that the difference in the post-test self-efficacy mean scores between the two groups can be explained by the reason of group difference at 3.4% of variance (a small effect size = .034).

Furthermore, Figure 10 portrays a remarkable difference margin between the two groups in their post-test self-efficacy means, which is concurrent with the finding described previously: Recall that the quantitative data demonstrated a statistically significant difference in the post-test online searching self-efficacy scores between the two groups.

Some remarks of the participants will be described in the following paragraphs to provide a qualitative cross validation.
In order to understand the change in self-efficacy of the participants in their online searches, they were asked to self-appraise their online searching capabilities. Participants’ views of their competency were diverse. According to Bandura (1997), self-efficacy beliefs are derived from four main sources of information: enactive mastery experiences, as indicators of capability; vicarious experiences, a transmission of competencies through comparison of others’ attainment; verbal persuasion and allied type of social influence; and physiological and affective state responses to experiences. Thus, the presentation of the qualitative data will focus on the experiences which might strengthen their self-efficacy level caused by the given approach.

The building up of self-efficacy
The analysis found that two resources contributed to the increase in online searching self-efficacy. One was successful searching experience, which refers to the relevance of the information they retrieved and the acknowledgement of such by the teacher; the other one was positive and timely feedback from the lecturer.

The results show that successful information searching experiences contribute to the increase in learner self-confidence. It was also found that the more knowledge and skills learners acquired, the greater the likelihood of success. As a result, some participants were self-confident in online searches because they easily located relevant information in comparison to prior experiences. As participant E19 remarked “My information search became quicker owing to the instruction about how to identify keywords and searching tips. This enabled me to be more efficient in every aspect of online searching. Also, information retrieved had more relevance. This
meant that I felt more confident and assured about the information needed”. E19:就是搜尋有比較快速，然後就是因為上課有教一些關鍵字或是收尋的技巧所以，讓我在不管線上圖書館哪一方面都搜尋得比較快速，就是找的資料也比較符合自己需要的，然後就是會比較有自信這東西就是我的我要的。Therefore, self-confidence, in terms of the self-efficacy beliefs of learners, spontaneously rose along with the increase in knowledge and skills.

Prompt and positive feedback from the tutor/researcher was another resource contributing to the increase in self-efficacy of the participants. Online searching is a complicated skill that requires three capabilities: Internet and computer skills; library searching skills; and subject knowledge. “Subject knowledge” refers to the ability to identify appropriate search topics and keywords, which demonstrates analytical and critical abilities. A deep learning approach is necessary for learners to feel competent in this respect. This intervention provided the participants with more interactive learning opportunities, including face-to-face interaction and online discussion. As a result, many of them agreed that they felt more confident and focused through interactions with the teacher/researcher. “We had more uncertainty during group members’ face-to-face discussion, for example, about whether or not the information was related to our case. Finally, we needed to consult with our teacher as to which results of our discussion were valid (E22).” E22:我們那組面對面討論會有比較多的不確定感，像什麼這資料是不是與我們的個案有關係，到最後還是要跟老師討論才有用。

Some of the participants responded that their previous online searching experience was distressing and had lead to uncertainties. For example, they had been given an assignment without further guidance from the teacher, and, because of uncertainty about expectations, had achieved poor results. Participant E7 expressed, “We were afraid that our assignments did not meet the requirements of the teacher when we were in clinical practice period. Because the teacher only gave us topics without a clear guide, we did not know what she expected. It was bothersome after we did our best and finally submitted our assignments to the teacher, but she was critical of our work (E7).”E7:幾乎實習做的報告，大家幾乎都趕在一起，然後就怕說做不好，
因為老師只是丢一些題目過來給我們，阿！我們並不知道他要的是什麼，全部報告就湊在一起，擠出來之後呈現給老師，報告出來她又在那邊念，很煩！

However, during the current research, there was more teacher-student interaction which focused on assisting with the completion of student assignments. The confusion in searching topics and keywords was reduced after these interactions. As a result, the participants felt more confident in completing their learning tasks. In addition, the intervention was informed by KALT, which stressed that a learning model should provide a respectful, humanistic, and accommodating learning environment. The learning atmosphere created by the intervention could be another resource that enhanced the self-efficacy beliefs of the learners. As participant E22 expressed: “I very much enjoyed learning methods of posting and responding in the virtual classroom! I was looking for feedback from the teacher after uploading information. Sometimes, my confidence was strengthened. The feedback motivated me and increased interactions with fellow students. Our members collaborated with each other then fulfilled their respective tasks.”

E22：我真的超喜歡網路上張貼回應的教學方式，就是收到的資料PO上去，期待老師對我的回饋，有時候真的自信心加分，讓我更有動力，也增加了不少互動，組員們也都合作無間，彼此分工合作。

Overall, a statistical difference between the two groups was found in their post-test self-efficacy scores. Also, remarks from the participants revealed that successful online searching experiences and positive learning feedback through the intervention contributed to the increase in self-efficacy. The intervention allowed the participants more interaction with the teacher/researcher. Moreover, they received more positive feedback through teacher-learner interactions.

5.4.5.4 SDLRSNE differences between the two groups

A statistically significant relationship between the pre-test and post-test SDLRSNE total means of the participants, F(1, 136) = 96.69, p < .001, partial eta squared = .41.6, was found in the differences in self-directed learning readiness of the participants between the control and experimental groups, as shown in Table 26 The post-test
SDLRSNE total means of participants can be explained by the pre-test SDLRSNE total means, the covariate, at 49.0% of variance.

Furthermore, a nonstatistically significant difference was found in the post-test SDLRSNE total means of participants between the control and the experimental groups after the effect of the covariate, the pre-test SDLRSNE total means administered before the intervention, had been statistically removed (F[1, 136] = .42, p = .52, partial $\eta^2 = .003$). This means that the group difference did not reach a statistically significant level for the post-test SDLRSNE total means of the participants. A very small effect size (.003) of the difference between the groups was found, which can explain merely 0.3% of variance of the difference in the post-test SDLRSNE scores between the two groups.

Figure 11 depicts the post-test SDLRSNE score having controlled for the confounding influence from the pre-intervention levels of SDLRSNE; that is, the estimated marginal means of SDLRSNE was used to draw this plot instead of the original post-test SDLRSNE total means. No statistically significant differences were found in the post-test SDLRSNE total scores of participants between the control and experimental groups when the pre-test scores were controlled for. Figure 11 also shows a slight fall in SDL levels for the control group and an increase in SDL levels for the experimental group. As this Figure illustrates, the estimated marginal mean of the experimental group is obviously higher than that of the control group.

![Figure 11. Plot of SDLRSNE total Means before and after the Intervention with Estimated Marginal Means for Post-test](image)

Therefore, effective size and power were calculated for SDLRSNE and indicated a nonstatistically significance difference. The eta squared for the analysis of SDLRSNE
was eta squared at .003, which is negligible effect (.01) (Pallant, 2011). Post-hoc calculations were performed on the sample size required to achieve a power of .8 for the test of the difference of two means with \( \alpha = .05 \), and more than 1500 participants per group as sample size were required; however, this was not a feasible/possible sample size for this study and the small effect size might lead to a nonstatistically significant difference.

**Different learning environments influence participants’ learning behaviour**

Despite the lack of a statistically significant difference between the two groups, this section provides findings from another perspective - describing the contrast in learning behaviour that existed between the two groups of participants who had been exposed to different teaching approaches.

The two approaches used in the current research study refer to two types of learning environment provided to the participants to encourage self-directed learning. Self-directed learning is not isolated learning, but learners can work in a self-directed way while engaged in group-learning settings, provided that is a choice they have made believing it to be conducive to their learning effort (Brookfield, 2009). This suggests that learners take responsibility for their learning, and therefore will be more engaged in the process and display a desire for learning. However, it was found that the intervention provided more teacher immediacy through interactive activities which encouraged the self-directed learning performance of learners.

It was found that the intervention created a learning atmosphere which promoted the engagement of the participants in a group-learning setting compared to the usual face-to-face instruction. Participants in both groups were required to complete a group assignment through discussion and collaboration. However, it was found that the usual instruction approach often limited further student-teacher interactions after classes. In contrast, the intervention provided adequate teacher immediacy through the use of an online forum after classes. As a result, the learning engagement of students was promoted. Participant E3 in the experimental group expressed that she more seriously engaged in the online discussion because she noticed that the researcher was following communications through the online forum. “*For example, our discussions were sloppy when we discussed via the use of MSN. But, we would both spontaneously*
and seriously engage in the discussion when it took place in the online forum which was under the supervision of the lecturer.” E3:因為我們在即時通，有時候會哈拉哈拉到就會說我們沒討論到，那如果是在網路教學的討論室，妳就都知道，妳是在網路教學裡面，老師有在看一定要認真討論。 Remarks of participant E7

echoed the previous opinion: “Certain members in my group who had more desire for learning would read and respond to the postings uploaded in the online forum. Meanwhile, we perceived the tension that existed amongst us while chatting in the e-platform. Our discussions would be more relevant to our topic because the lecturer/research followed these discussions.” E7:像我們這組比較會有心要做的就會上去看，再下去做回應。那像聊天室的話，或許大家都有個壓力在，因為小組內容老師會看，所以就會比較針對問題下去問。In short, the analysis revealed that adequate teacher immediacy encouraged learners to be more engaged in their group work.

Remarks from participants in the control group demonstrated that the engagement of students in group work would be less active if the teacher was not present during the process of group learning. The use of a group teaching strategy requires teachers to facilitate student contributions to the group task instead of their being isolated learners. However, usually, teachers cannot participate in each group discussion and give feedback because of the limitation of time and distance. As a result, the learning effectiveness of a collaborative work assignment could be reduced if aspects of the assignment are unclear to the participants, accompanied by a low participation rate.

This is illustrated by the comments of participant C14 who received the usual face-to-face instruction: “According to my group learning experience, group work still remained in the situation that each member solely completed their assigned jobs. Some might be shy or unwilling to ask help from other members. As a result, they used their own way to locate information. Alternatively, perhaps, some believed that she fully understood and she might think that what she entered was of no significance. In the end, certain results would be yielded and were randomly picked up. Thus the reason for those who still did not know how to search could be personal laziness and having no interest in the assignment. I thought each student should be required to join the discussion about keywords identification and information retrieved.” C14：其實在我們小組，我認為就是，因為每個人還是分配自己的工作，所以就各自回去
A theory underpinned web-enhanced education motivates participants’ learning

The second finding was a changed attitude toward learning through interactive learning activities. Participants in the control group had previous web-enhanced learning experiences but received only a face-to-face instruction for online searching skills. Therefore, they used the e-platform only as an information exchange vehicle between the lecturer and students. They did not regularly log on to the e-platform unless they were required by the lecturer to read notices or download information from the lecturer. The remarks of participants illustrate this phenomenon. “I seldom logged on to the e-classroom unless someone told me that some important announcements were posted or I was requested by the teacher to log on to... I believed e-classroom was a means to find information for the assignment formats and tests; or I could download the slides that were used in the class. The slides would help me to acquire the key points that had I missed in the class while falling asleep (C15)”. 

C15：我其實平常都不會上網路學園的，然後除非同學說網路學園有重要的事情公佈或是老師叫我們上去，我才會上去...C15：我覺得我把網路學園當做是，就只是一個應付考試或報告不懂的地方，看老師 po 上去的格式，要不然有時候老師上課用 power point，然後有時候是上課一不小心恍神之類的，就會上網路學園找老師的 power point 再做重點。 The remark was reinforced by another participant who said “I infrequently logged onto the e-classroom. I would log in to download new information and then immediately logged off after it was done without further browsing new information (C16).” C16：我是很少上去網路學園，有新的資料我會去上網去抓，抓完就把它關掉，就沒有去看有沒有新的了。

Some participants complained that their previous web-enhanced learning did not include further student-teacher interaction. Many teachers simply used the e-platform as a vehicle to deliver supplementary information to students. They assumed that
students would be more satisfied with their learning because abundant information was provided to the students. However, content-focused learning could not motivate students’ learning when the given information was isolated from teacher-learner interactions. As a result, students considered the use of the e-platform as an excuse for laziness and an irresponsible performance by teachers. Teachers became dependent on the technology and neglected their interaction with students. “Since the beginning of this semester, I have felt that teachers have become very dependent on the use of the e-platform. They need to change and abandon the use of the e-platform to teach students. Our study was campus-based so we needed teachers to give us further explanation rather than only upload supplementary information in the e-classroom (C12). “C12: 我覺得這學期，不知道是不是四年級的關係，老師變得很依賴網路學園。...我覺得說老師要改，不要用網路學園，就是教學生。我們是在學校上課不是在用電腦上課，我們需要的是實體的老師講解，因為妳這樣子妳都是依賴說我有補充，然後都在網路上。The remarks of this participant illustrate the importance of integration of student-teacher interaction into e-learning.

In contrast to experiences of the participants in the control group, participants in the experimental group described their learning experiences through the intervention in positive terms. The intervention was informed by KALT and, hence, the learning process itself was emphasized. Several interactive activities were included to support the self-directed learning of the participants. First of all, group dynamics increased through the interactive online learning activities. The participants did not have prior online discussion experience, but, after the intervention, their group work learning experience was broadened. As one participant commented, “I felt this learning approach was fantastic. It not only enlarged our understanding about group discussion approaches but also made a big turn concerning our attitude towards assignments (E21).” E21：我覺得很棒，因為可以讓我們知道更多團體討論方式，也讓我們在做報告上的態度大有改變。They also agreed that they were more engaged in the collaborative work through the use of the online forum. The remarks of participant E19 concerning their group dynamics: “Now we have improved to some extent. Once you posted your subject (in the online forum), the other group members would respond to you with criticisms or suggestions (E19).” E19：現在已經進化到你丟一個題目出去，人家看到還反駁你，妳哪裡不太對或要補充的地方。
Furthermore, they behaved more responsibly in trying to complete their group work through the use of the intervention. “Before this time, normally, there were only a few team members doing the group assignment...I was so annoyed as a team leader that I needed to do the rest of the group’s work (E20).” E20：以前都只有幾個在做而以...對呀！剩下的都組長在做，根本就很不爽。

Active learning and desire for learning in the participants also occurred after experiencing the intervention. The intervention included an online forum in which both the learners and the researcher participated. In order to support participant learning, the researcher followed the online discussion of the participants and gave feedback twice a week over a four week period. Eventually, motivation to learn and the active learning behaviour of the participants were promoted after they experienced the interactive online forum. As participant E21 commented “the use of the online discussion board gave me a desire to log on to the discussion board and look forward to new information from peers or feedbacks from the teacher.” “It leads me to look at the discussion board for new notes or slides that are provided by the teacher in the e-classroom before starting my assignment. I frequently logged on to the e-classroom and sometimes I was surprised with what I found.” E21:我們是在張貼的地方放東西，就是你有時候會想上去看看，有沒有同學放新的東西上去或是老師的回覆，會想要去一下。學習意願就是當你做到其她的報告什麼的時候，會想說，老師有沒有貼東西可以參考，看你需要的，有時候功課或是 Power point 的重點呀！就是常上去看，有時候會有驚喜喲！ This idea was supported by another participant E10, who said “I felt the information was helpful for me. I logged on to the e-classroom every day to read up-to-date information from the lecturer/researcher when I had time available (E10).” E10：我覺得這些對我來說很有幫助，因為我每天有空都會上去看，看老師更新的資料。

Overall, the statistics did not demonstrate a significant difference in the post-test SDLRSNE between the control and experimental groups. However, qualitative data revealed that the intervention provided adequate teacher-learner interactions which encouraged the development of self-directed learning behaviours of the participants.
The participants reported that their desire for learning and engagement in group work improved through the intervention.

In summary, the results of the Research question 5 showed that a significant difference was found in the mean scores of post-test self-efficacy between the two groups. No significant difference was found between the two groups of participants in their post-test knowledge, skills, and SDLRSNE total mean scores. The result indicates that the different learning approaches (experiences) of the participants did not make a difference in their scores of online searching knowledge, skills, and self-directed learning readiness after the intervention period. However, the nonsignificant findings in the post-test knowledge and SDLRSNE total mean scores between the two groups might be caused by the small sample size that was used in the research. A statistical summary is provided in Table 27, which shows a comparison between the two groups across the aforementioned four variables. They were measured after the intervention period while controlling the influence of each of the covariates (the pre-test scores).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Control</th>
<th>Experimental</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Estimated marginal mean (SD)</td>
<td>Estimated marginal mean (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Knowledge</td>
<td>10.94 (1.86)</td>
<td>11.17 (2.20)</td>
<td>.73</td>
<td>.464</td>
</tr>
<tr>
<td>Skills</td>
<td>7.21 (.95)</td>
<td>7.24 (.84)</td>
<td>.22</td>
<td>.829</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>6.25 (1.41)</td>
<td>6.69 (1.41)</td>
<td>2.19</td>
<td>.030*</td>
</tr>
<tr>
<td>SDLRSNE</td>
<td>144.13 (18.40)</td>
<td>145.53 (17.00)</td>
<td>.65</td>
<td>.520</td>
</tr>
</tbody>
</table>

Sig. (2-tailed), * p< .05.

However, remarks from the participants in the focus groups revealed further information including the process of gaining knowledge, factors contributing to mastering skills, resources enhancing the building of self-efficacy, and the change in becoming more orientated towards self-directed learning.

It seems that the different teaching approaches made no difference in the achievement of knowledge, skills, and readiness for self-directed learning. However, the qualitative data revealed that the intervention provided more learning resources which included
useful online materials and more teacher-learner interaction that were conducive to learning. Hence, a positive evaluation towards online searching skills education, more engagement, and self-directed learning behaviours were present in the experimental group. Adequate teacher immediacy was found to be the most important factor that facilitated the participants’ knowledge gain and accumulation of searching experiences, as well as encouraged the performance of self-directed learning behaviour amongst participants. Online searching self-efficacy of the participants was also strengthened by the receipt of positive feedback from the teacher/researcher through the interactive learning process.

5.4 Summary

This research used a mixed methods intervention design with focus group discussions, following pre-and post-test questionnaires to answer the five research questions:

1. What was the level of the ‘online search knowledge’ of the control group and the experimental group before and after the intervention period?
2. What was the level of the ‘online search skills’ of the control group and the experimental group before and after the intervention period?
3. What was the level of the ‘online search self-efficacy’ of the control group and the experimental group before and after the intervention period?
4. What was the level of the self-directed learning readiness of the control group and the experimental group before and after the intervention period?
5. What was the effect of an educational intervention on the online search knowledge, skills, self-efficacy, and self-directed learning readiness of ADN students in the intervention cohort compared to ADN students who received usual instruction?

All underlying assumptions of statistics used in this research were checked and found to be met before conducting the analyses. The results showed that participants in both groups demonstrated a statistical increase in their online searching knowledge and skills after the intervention period. However, participants still showed a weakness in the aspects of keywords identification and in using advanced searching skills.
The participants in the experimental group demonstrated a statistically significant increase in their post-test OSSI scores after the intervention period; at the same time, the OSSI scores of participants in the control group remained on a plateau. The post-test SDLRSNE total scores of participants in the control group slightly decreased; however, the post-test SDLRSNE total scores of participants in the experimental group grew but at little statistical difference.

The comparison of the four outcome variables (knowledge, skills, self-efficacy, and SDLRSNE) in the post-test after the partial removal of the influence of pre-test scores (the covariates) found that only the post-test self-efficacy mean of the participants in the experimental group significantly differed from that of participants in the control group; the post-test scores of the other three variables were not significantly different. Although the post-test knowledge and the SDLRSNE total mean scores of the participants in the experimental group were higher than of the control group, no statistically significant differences were found. The non significant findings might result from a small sample size used in the research.

Four crucial elements were revealed from focus group discussions, which explain the development of knowledge, skills, self-efficacy, and self-directed learning readiness of the participants:

1. more interactions between the lecturer and the participants facilitated the increase in online searching knowledge;
2. more practical exercises enhanced the participants’ skillfulness in online searches;
3. timely feedback promoted self-efficacy of the participants; and
4. a learner-centred learning approach enhanced their desire for learning and responsibility.
Chapter 6: Discussion

Chapter 5 has outlined the results of the data analysis in relation to the effectiveness of the two different teaching methods for improving the Associate Degree in Nursing (ADN) students’ information literacy (online searching knowledge, skills, and self-efficacy), and self-directed learning (SDL) readiness. This chapter presents an analysis of this current study and three inter-related areas are separately discussed:

1. ADN students’ readiness for information literacy;
2. matching a web-enhanced approach (informed by the principles of Knowles) with students’ information literacy learning needs; and
3. methods that encourage participants’ SDL.

6.1 Participants’ readiness for information literacy

This section discusses three aspects of the information literacy readiness of the ADN student participants in both the control and experimental groups (hereafter abbreviated to “both groups”: their online searching knowledge, skills, and self-efficacy. Overall results strongly suggest that information literacy education for ADN students in using databases should commence at an early stage in the program.

6.1.1 Online searching knowledge and skills

The results of this study show that there was a statistically significant increase in the online searching knowledge test (OSKT) and online searching skills test (OSST) scores of the participants in both groups after they received their education session/s. The significance and benefits of retrieving relevant information from high quality academic resources such as Airiti Library, rather than through Google and Yahoo, were understood and acknowledged by the participants. The students reported that the education they received had improved their ability to locate information effectively; for example, by integrating keywords into searching strategies. Their location and retrieval of relevant clinical articles both indicate that the participants increased their
library skills, skills that are essential components of information literacy (Lupton, 2004).

The findings of this study concur with those of other studies that found students’ online searching literacy improved significantly after they were provided with computer-assisted instruction (CAI) and face-to-face instruction (Beile & Boote, 2004; Brettle & Raynor, 2013). However, the students in the Beile and Boote (2004) study were enrolled in postgraduate education programs and they almost certainly would have had previous relevant experience using library databases. Similarly, the Brettle and Raynor (2013) study focused on postgraduate nursing students’ searching skills using the Cumulative Index to Nursing and Allied Health Literature (CINAHL) on a given topic area. This differs from the current study in which students selected their own topic. The ADN students would almost certainly feel more confident and may have found selecting keywords easier than if they had been given a topic. Apart from these differences, the results from both these studies (Beile and Boote [2004] and Brettle and Raynor [2013]) may not be transferable to the ADN students in Taiwan because the numbers were small, with fewer than 30 in each group. Despite this, the findings of this current study and others indicate that instruction can effectively improve students’ online searching knowledge and skills, i.e., their online searching literacy, whether given using an integrated e-learning or face-to-face delivery format. Further discussion addressing the associated teachings styles and learning outcomes is presented in the following section to add light to this complex issue.

An important feature of the current study is that it included structured collaborative learning through a group assignment for all students. Many participants in the control group discussed their assignment with the course lecturer who provided feedback assisting these students to locate relevant information and use it for their group assignments. Lecturers’ feedback has historically been an intrinsic component used in combination with face-to-face instruction to support students’ learning, and so it was appropriate for the control group to receive multiple teaching delivery methods, including initial instruction, lecturer drop-in sessions, and peer learning in the form of the group assignment work. This is in keeping with KALT which emphasises that it is essential to use collaboration and group learning to promote learning (Knowles et al., 2005).
Alfassi (2004) and Swanson (1999) argued that when a teaching strategy uses a combination of modes of instruction positive student learning outcomes are more likely to occur as different learning styles are accommodated. This use of more than one teaching and learning strategy might have contributed to the significant improvement of the OSKT and OSST scores in the control group. Empirical evidence supports the proposition that setting a group assignment as a learning activity can be expected to promote knowledge and skills, and to motivate students (Cabrera, Crissman, Bernal, Nora, & Pascarella, 2002; Wyk, 2012; Zakaria, Chin, & Daud, 2010). The literature on higher education learning is unequivocal on the point that assessment activities motivate, and therefore can potentially demotivate, students’ study behaviours (Biggs, 2002; Biggs & Tang, 2006; Ramsden, 2003; Sadler, 1987). As Knowles, Holton, and Swanson (2005) suggest, adult learners are more heterogeneous in their learning styles, motivation, needs, and interests than are children or youths, and there is no one teaching/learning strategy that will match all adult learners’ needs. They recommend peer-helping activities and experiential methods. Therefore, it is reasonable to speculate that this may have been the case in the current sample of ADN students and highlights the important part that assessment plays in student learning.

In contrast, Anderson and May (2010) found that the information literacy of first year undergraduate students who were enrolled in over 15 academic programs across the university increased after face-to-face instruction, but not to a significant extent. The sample size used was small and these undergraduate students arguably had high levels of knowledge (scored at 85%) before the instruction, which could explain the non-significant increase. Anderson and May (2010) argue that there is a need to integrate a broader teaching approach into information literacy education as more and more web-based resources will be used in this computer technology era.

6.1.2 Online searching self-efficacy

The baseline online searching self-efficacy inventory (OSSI) scores indicate that the online searching self-efficacy levels of the ADN students (both in the control and
experimental groups) were neither high nor low, but rather mid-range (6.05-6.64, range from 1 to 12) (Monoi et al., 2005). This result is supported by comments made by participants in the pre-test focus groups. They stated that they primarily searched for information using Google and Yahoo: i.e., they had experience locating information from electronic resources using phrases and words, although they were not familiar with using all the features of library databases. It is therefore understandable that they had limited confidence in locating information using library databases. This is consistent with an American study (Monoi et al., 2005) that reported on university students enrolled in an online credit course involving online searching; these students had similar mid-range scores before receiving information relating to searching training. According to an unpublished master’s degree thesis completed by Yang (2009), Taiwanese ADN students self-reported having information literacy confidence of a middle range. Yang also used a researcher self-developed questionnaire that had not been published but was validated using a factor analysis. The total variance explained by the four factor scale (24 items) was 41.74%; this scale showed a good total scale Cronbach’s α value at .89.

In the current study, the post-test mean OSSI scores (6.05 to 6.64, \( p = .001 \)) indicate a statistically significant improvement in the online searching self-efficacy of the experimental group that was not demonstrated by the control group. The OSSI scores of the control group remained unchanged at 6.29. The statistically significant increase in the experimental group’s OSSI scores is consistent with the increase found by Beile and Boote (2004) in the library skills self-efficacy levels of postgraduate education students who had had a web-based library tutorial. However, the generalizability of Beile and Boote’s study is problematic as their sample size was very small (fewer than 15 students in each group), the participants were very different from those in the current study, and the measurement tool used by Beile and Boote was not validated. Importantly, however, Monoi, O’Hanlon, and Diaz (2005) used the same OSSI scoring tool as the current study and also found a statistically significant increase (5.97 to 8.54, \( p < .001 \)) in the mean scores of undergraduate students. This increase in the OSSI scores is greater than was found in the current study. This might be a result of the longer period of instruction: In contrast to the participants in the current study’s intervention, their students undertook an entire online research skills course.
The increase in the OSSI scores in the experimental group in the current study can in part be explained by comments made by participant E1 (see pp. 157-158). She commented, for example, that questions that arose and difficulties that she encountered while she was completing the assignments could be quickly solved with the assistance of the researcher’s timely feedback using the online forum. The control group did not receive this support. The intervention’s self-paced online learning package was also useful in helping the experimental group students to find potential solutions to problems. This is consistent with a small UK study by Craig and Corrall (2007) that found handouts, availability of help from staff, and feedback from small-group sessions influenced the information searching self-confidence of Diploma in Nursing students. The results of this study and others indicate that the increase in students’ online searching self-efficacy may have occurred as a result of an accumulation of positive experiences. This is consistent with Bandura’s (1997) Self-Efficacy Theory and KALT. The assumption of Knowles that experiential learning optimizes adults’ learning is reinforced.

There was a non-significant increase in the OSSI scores of the control group after the intervention period. This is inconsistent with the results of other studies that also used traditional face-to-face instruction but found a significant improvement in nursing students’ information literacy confidence (Courey et al., 2006; Craig & Corrall, 2007; Ku et al., 2007; Shorten et al., 2001; Tarrant et al., 2008). This may be due to design differences, in particular, the use of different measuring tools (Courey et al., 2006; Craig & Corrall, 2007; Ku et al., 2007; Shorten et al., 2001; Tarrant et al., 2008), and a longer period of information literacy education (Courey et al., 2006; Craig & Corrall, 2007; Ku et al., 2007; Shorten et al., 2001; Tarrant et al., 2008).

Four studies were undertaken in different countries that are obviously quite different to Taiwan (Courey et al., 2006; Craig & Corrall, 2007; Shorten et al., 2001; Tarrant et al., 2008), and in two studies the students were more mature people who had previous clinical nursing experience (Ku et al., 2007; Tarrant et al., 2008); any of which may have introduced factors contributing to their results. Age, previous experience, and cultural differences have been found to influence one’s self-efficacy belief (Bates & Khasawneh, 2007; Chyung, 2007). These differences create difficulties in making
direct comparisons, but they also help to explain differences in the results and findings.

Comments made by control group participants during the post-test focus group discussions help to explain the plateau in the control group’s OSSI scores. They commented that they experienced feeling overwhelmed and that information recall presented challenges after only receiving one session of face-to-face instruction. The participants expressed a need to have additional support from teachers (see pp.157-158); the lack of teacher presence in their group discussions might be one factor that prevented them from building their self-confidence about specific skills, such as identifying keywords, and using advanced searching skills (Craig & Corrall, 2007). The control group students had less opportunity to receive timely, positive feedback from teachers (significant others) compared to the experimental group. As Bandura (1997) has argued, encouragement from personal contact with the lecturer, no matter which medium, is an effective resource in strengthening students’ self-efficacy belief.

6.1.3 Participants’ information literacy weaknesses

The current study found several weaknesses in the participants’ information literacy after the intervention, despite a statistically significant increase in the overall OSKT and OSST scores of participants in both groups. The results indicate that the students needed further instruction and training about using databases, which is congruent with Dee and Stanley’s (2005) recommendations that highlight the necessity for nursing students to have more database searching skills training. The OSKT scores of all the fourth year ADN students (in both groups) remained in the moderate range (marks around 70%)\(^26\), whereas their OSST scores increased from the low range (marks around 37%) to the moderate range (marks around 66%)\(^27\). As shown in Table 19 (see page 137 in Chapter 5, Results), the participants’ lowest scores after receiving instruction and support were for their knowledge of advanced searching. When the online searching skills test was conducted, the participants made less use of advanced searching skills, such as using fields and limiters to increase the specificity of their research (see Chapter 5, Table 21, page 142). Comments made by the participants in

\(^{26}\) The OSKT mean = 10.95-11.16 (the range is between 0 and 16).

\(^{27}\) The OSST mean = 7.22-7.23 (the range is between 0 and 11).
both groups also revealed that they still encountered difficulties after the intervention period in identifying search keywords and the use of advanced searching techniques, such as Boolean logic, to construct effective searching statements.

These observations from this current study confirm previous studies completed in the UK (Craig & Corrall, 2007; Grant & Brettle, 2006), Australia (Salisbury & Ellis, 2003), and Taiwan (Chen Lin Ching 林菁, 2008) with higher education students. All these studies of nursing students and those in other disciplines report a statistically significant increase in students’ information literacy scores after an education intervention; but the students still had low scores in various specific areas of online searching knowledge and skills. Salisbury and Ellis (2003) suggested that the low skills performance may have been caused by students’ lack of previous experience in using library databases as information resources; a one-hour tutorial would not be adequate for students with limited previous experience to grasp more complex searching concepts, such as Boolean logic. The results of these studies and those of the current study strongly indicate that integrating advanced searching skills into their search statements is a common difficulty for all students (both nursing students and those in the humanities disciplines).

An earlier study by Chen Lin Ching 林菁 (2008) undertaken in Taiwan also found that undergraduate students expressed difficulty in identifying alternative keywords and synonyms, and that they could not broaden searches or use limiters to narrow down search scopes after a one-semester information literacy course (16-18 weeks). This speaks to the necessity for ongoing student-teacher interaction which focuses on each individual’s needs (Craig & Corrall, 2007). It is particularly important to support students who initially have limited database knowledge and skills to help them to develop the knowledge and skills necessary to construct effective searching strategies (Churkovich & Oughtred, 2002). This need was also expressed in the comments made by participants in the current study. In the focus groups, students reported that they felt reoriented and confident to continue their work whenever the lecturer or the researcher was involved in their group interaction. This reflects Knowles et al.’s (2005) statements that the knowledge and experience of others, encountered in group discussions and collaboration with help from facilitators, can be the richest learning
resource for adult learners. The role of the adult educator is to assist students move from being dependent toward being self-directed learners (Knowles et al., 2005).

Regardless of the key facilitating role educators can play, the process of identifying keywords to incorporate into search statements and advanced search techniques requires students to exercise their communication, critical thinking, and problem-solving abilities. These are classed as generic fundamental information literacy skills (Lupton, 2004). These skills cannot be directly transferred from the instructor to students. Furthermore, the identification of keywords and applying Boolean logic have, for many decades, been ranked as higher order cognitive learning objectives (Bloom, 1956); and, according to Benner’s (1982) From Novice to Expert Theory, it can take years for database novices to become competent users. These factors and the findings of this study both strongly indicate that information literacy education for ADN students should start in the early years of their diploma. Some teaching staff in ADN nursing programs consider that their students do not need database searching skills until they enrol in the research course in the latter years of the ADN program. The impact of deferring the teaching, and therefore the students’ learning of database searching skills, is multifaceted. The delay is likely to, in turn, further delay students becoming more information literate, affecting their information literacy levels, and further reduces their capacity for optimal quality evidence-based nursing practice in clinical settings.

Regardless of how appropriate the theoretical framework informing an intervention is, other factors may adversely impact upon learning outcomes. The duration of the intervention and students’ very limited prior searching experiences with databases may have an inhibiting effect on possible improvements (Salisbury & Ellis, 2003). Students with prior related experiences are likely to achieve the highest information literacy competencies (Hao Chia-Chi 郝家琪 & Hsu Li-Ling 許麗齡, 2008); such experiences assist them to more smoothly acquire new knowledge and new skills. Participants in the current study valued experiential learning and thought that it improved their mastery of research skills.
The ADN students in the current study showed low achievement in using advanced searching skills, unlike the postgraduate nursing students in a small study in the UK (Grant & Brettle, 2006) who were found to use more advanced searching techniques after receiving the instruction. Higher academic expectations were made of the master’s degree level students ($N = 13$), which included being required to undertake a systematic literature search on a topic of their choice, to describe the literature search process, and to present search strategies. All of these may very likely have contributed to the positive findings of the Grant and Brettle study for this small group. The students in this current study were required to undertake a simpler, more straightforward activity, appropriate to their program level.

Levels of student achievement in acquiring and/or improving searching skills are not necessarily related to the frequency of use; they can also be related to expectations and course requirements. The current study participants revealed that during the first three years of their program they were not required to include any references from academic databases in the assignments they submitted. Consequently, in their fourth year, they were still effectively database novices; for this reason, the requirement for their assignment for this research study was for approximately 10 references. That is, the expectations for the ADN students were understandably not as high as those for Bachelor of Nursing students.

Another possible explanation for the low frequency of use of advanced research skills demonstrated by the participants in the test after the intervention is that their online searching behaviour in the test was different from the way they perform online searching in the real world. It may have been difficult for these academic database beginners to demonstrate relatively advanced searching behaviour, which they were beginning to become more familiar and confident with, during the short test period (of generally less than 30 minutes). Certainly, participants in the experimental group (page 161, E22; page 170, E19) were able to describe appropriate ways to access useful information for their assignment by seeking peer assistance. They would then adjust their searching strategies and conduct further searches. This highlights a limitation to this form of testing. Real world online searching essentially has the same format; it is a cyclical ongoing reiterative process. In everyday life, further searches are frequently required after retrieved information is first evaluated. More keywords,
synonyms, combined searching, and certain field limits are then used to try and yield more precise searching results. The test format did not allow students to demonstrate whether they could now do this.

### 6.2 Matching participants’ learning needs

The positive effect on students’ self-confidence associated with timely online feedback may also explain the statistically significant improvement in the OSSI scores of the experimental group. The difference with the control group’s scores may be a result of the different teaching methods. Participants in the experimental group also had higher OSKT and OSST scores than the control group; although the difference was not statistically significant. This indicates that both traditional face-to-face teaching and online self-directed learning (provided in the intervention) can result in improved online searching knowledge and skills.

The qualitative data from the current study provides insight into more appropriate teaching methods to support Taiwanese ADN students’ information literacy education. Comments made by the control group participants indicate that this usual face-to-face research skills instruction did not appear to fully meet their needs and could be improved (see Chapter 5, section 5.4.5). Participants in the control group commented that they needed additional support, including more hands-on exercises and discussions with their lecturers. In contrast, both learner satisfaction and appreciation of the usefulness of the e-learning strategies were reported from participants in the experimental group. When asked, they agreed that the integration of the self-paced online learning package provided them the flexibility to revisit learning content by reviewing the videos and with more interactions with the researcher (see section 5.4.5). The participants in the control group had no videos demonstrating the searching skills and no interaction with the researcher to assist with finding information using databases.

The implications of the quantitative and qualitative data analyzed together are that multi-modal teaching supports learners’ needs and results, and increases student satisfaction with the teaching/learning experience. Once again, this is consistent with
the KALT principle that experiential learning, such as group discussions, problem-solving activities, and laboratory methods with lecturers’ facilitation, will augment adults’ learning. This is discussed in more detail in section 6.2.3.

6.2.1 Promoting participants’ online searching self-efficacy

The statistical findings of this study suggest that such an intervention, a web-enhanced approach guided by the principles of Knowles and PBL (Barrows & Tamblyn, 1980), can more effectively strengthen the participants’ online searching self-efficacy levels compared to usual face-to-face instruction. The statistically significant increase in the participants’ self-efficacy level after receiving the intervention is consistent with previous studies that found that using educational interventions informed by KALT and other theories, such as Bandura’s (1997) Self-efficacy Theory, effectively improved nurses’ or students’ self-efficacy level (Andrighetti et al., 2012; Mayer et al., 2005; McKenna et al., 2011; Noel-Weiss et al., 2006).

Andrighetti, Knestrick, Marowitz, Martin, and Engstrom (2012) successfully used simulated learning, guided by Knowles’ principle of experiential learning, to promote the self-efficacy levels of midwifery students regarding managing maternal complications. This approach provided practice opportunities and group debriefing sessions. Simulation of real situations meant students learnt by doing and they were able to be a resource for their peers in the debriefing sessions. Similarly, McKenna, O'Brien, and O'Shea (2011) effectively strengthened nurses’ confidence about giving a second opinion in a court hearing using a program with a video clip and a role play. These teaching strategies are guided by the assumption that for adults transfer of knowledge and skills is based on learners’ previous experience (Knowles et al., 2005). The accumulation of relevant experience through practice contributes to successful learning and self-confidence in a specific area. A participant in the experimental group (E19, see page 143) commented that she became more confident about searching for information using the Airiti Library because she repeatedly made use of it.
Effective problem solving experience in a specific area contributes to one’s self-confidence. The group assignment used in the current study was designed to incorporate the concept of problem-solving, learning with real life oriented scenarios as closely as possible, and to effectively assist the experimental group participants to complete their assignment. It has features similar to other studies which used a practice-based workshop (Noel-Weiss et al., 2006) and a self-directed learning manual (Mayer et al., 2005) guided by the integration of KALT and Bandura's (1986) Self-efficacy Theory to promote nurses’ self-efficacy (providing health promotion counselling to patients) and primiparous women’s breast-feeding self-efficacy. The outcomes in these studies were in real life settings and the practice opportunities supported improved self-efficacy. These previous studies, however, need to be treated with caution when applying the results to an e-learning setting. They did not incorporate e-learning and had weaknesses in their methodology, including small sample sizes (Andrighetti et al., 2012; Noel-Weiss et al., 2006) and a lack of a control group (Mayer et al., 2005; McKenna et al., 2011).

The researcher found that completing the group assignment did not seem noticeably to benefit participants in the control group. Their OSSI scores remained unchanged. They revealed that several group assignments had simply been completed by the group leader or by a small number of the group members, rather than by all the group members. Therefore, some students in the control group did not participate in authentic information searching using the Airiti Library (C16, see page 161 and C14, page 169). The resulting lack of hands-on practice for those students might well be a factor that contributed to the lack of improvement in their self-confidence.

This current study found the absence of teacher facilitation could be a critical factor causing inadequate group interactions among the students, consistent with Van Berkel and Dolmans’ (2006) study that found that quality facilitation by tutors enhanced student achievement and group functioning. Horng Meei Ling 洪美齡, Huang Wen Wen 黃雯雯, & Wang Wen Ching 王文景(2010) similarly found that traditional student group discussions without teacher facilitation lead to poor group dynamics and a low level of engagement. According to Bandura (1986), situations with inadequate or no real hands-on practice nullify the potential learning benefits that
more practice and successful experiences can provide. Thus, the potential increase in students’ self-efficacy in using library databases is hindered.

**The importance of facilitators in promoting students’ self-efficacy** Quality facilitation can effectively motivate group dynamics and students’ participation in PBL (Baker, 2001). It can also enhance learning through the completion of group assignments. Knowles et al. (2005) highlight the significance of facilitation provided by the educator through the use of experiential techniques such as group discussion, simulation exercises, problem solving activities, and case methods.

The current study found that a motivated lecturer, acting as a learning resource and group interaction facilitator, played a role in contributing to an increase in participants’ online searching self-efficacy. A participant (E22, see page 164), a database novice, agreed that the teacher’s sharing of her experiences when participating in group discussions was effective in assisting her to identify appropriate keywords, construct effective searching strategies, and evaluate information retrieved from the databases. The function of the researcher in the current study was similar to that of a preceptor in clinical teaching. The preceptors act as role-models and provide resources for nursing students to facilitate their learning in clinical settings (Shepard, 2009). The experiences a preceptor or tutor shares during student-tutor discussions can serve as a bridge to guide and support students to transfer their previous experiences to a new learning situation and to find solutions for their problems (Sorensen & Yankech, 2008). Similarly, comments made by students in a study by Poellhuber, Chomienne, and Karsenti (2008) indicate that adequate support from academic staff was a crucial element contributing to their satisfaction, motivation, and student engagement.

The current study also found that facilitation guided by the KALT can create a supportive learning environment where the participants’ self-efficacy is strengthened. A learner-centred environment based on KALT is one where learners perceive they are being cared for, accepted, trusted, and understood. Online forum comments made by one participant in the experimental group indicate the importance of “being accepted and encouraged” by the researcher. The experiences portrayed during online
discussions by the participants in this current study are evidence of view of Knowles et al. (2005) that learners’ experiences are related to their self-identity. Similarly, one’s self-efficacy beliefs are influenced by affective state responses to experiences and verbal persuasion and allied types of social influence from significant others (Bandura, 1997). The findings concur with a Canadian study (Grightmire, 2009) that found nursing students’ self-efficacy beliefs in regards to their clinical skills were promoted when they felt supported and had a feeling of acceptance from teachers and staff in clinical settings. The findings suggest that KALT is appropriate for guiding information literacy education and strengthening ADN students’ self-efficacy.

6.2.2 The significance of online searching self-efficacy

This study found that self-efficacy is an effective predictor of the participants’ knowledge and skills in specific areas. There was a low to medium correlation between students’ online searching self-efficacy and their knowledge (r = .35, p < .001) and skills results (r = .17, p = .041), as shown in Table 25 (see Chapter 5, p. 150). This is consistent with prior studies that report a significant correlation between participants’ self-reported searching skills confidence and their real searching knowledge and performance (Beile & Boote, 2004; Mehrad & Rahimi, 2009; Monoi et al., 2005). Comments by a participant (E 19, see page 143) in the current study support the statistical findings. She said that the increase in her confidence about online searching was based on acquiring knowledge and mastering skills. The study completed by Beile and Boote (2004) and Mehrad and Rahimi (2009) support students’ information searching self-efficacy being an effective predictor of their actual knowledge and skills performance.

Arguably, self-reported research skills scores and reality do not always perfectly match (Pajares, 2002) because undergraduate students usually overestimate their information literacy competency abilities (Maughan, 2001). Craig and Corrall (2007) recommend combining subjective and objective evaluation methods to enhance research evidence. In fact, the improvement in students’ self-efficacy levels might be more significant in some ways than their performance reflected on the test scores. The increase in self-efficacy levels is an increase in learning motivation (Liang & Wu,
2010; Waldman, 2003) and in satisfaction (Liaw, 2007) about the specific skills, and
it is students’ confidence that brings them back to the use of the tools available to
them (Holman, 2000). Research suggests that students with higher levels of self-
efficacy are more likely to learn, in this study about library databases, and to use
library electronic resources (Waldman, 2003).

Objective and subjective evaluations are both useful tools for measuring the
effectiveness of an educational program; however, an actual increase in students’ self-
efficacy level is more important than the increase in their test scores (Holman, 2000;
Liang & Wu, 2010; Liaw, 2007; Waldman, 2003). Results from the current study
suggest that the so-called “objective learning evaluation”, such as a knowledge and
skills test (Grant & Brettle, 2006), can be replaced by the OSSI when investigating
students’ online searching skills using a large sample size. The OSSI can be more
broadly used than a quiz, which will usually be content-focused and will vary from
one database to another one. It is not feasible to develop a universally applicable
online searching knowledge and skills test because the questions in such tests related
to identifying appropriate searching statements are normally strongly related to the
features of particular databases and discipline knowledge. For example, the questions
and the authentic searching skills scenario used in this current study were aimed to
measure knowledge and skills of fourth year ADN students in Taiwan, who are
assumed to be database novices. The quiz and the basic typical scenario used may not
be suitable for Bachelor of Nursing students, postgraduate nursing students, or
students in other health disciplines. This explains why no objective research skills
evaluation tool (knowledge and skill tests) has been repeatedly applied in the research
studies reviewed in the literature review undertaken.

6.2.3 Matching participants’ learning needs using a technology-enhanced
approach

If one only looks at the quantitative data of the current study, it suggests that face-to-
face instruction and web-enhanced education are equally effective in promoting
students’ online searching knowledge and skill. The results are consistent with those
of other studies earlier described in section 6.1.1 (Beile & Boote, 2004; Brettle &
Raynor, 2013). Similarly, Churkovich and Oughtred (2002) found a statistically significant increase in the library skills and self-confidence scores of first-year sociology students in Australia regardless of the method used. However, the students who received face-to-face instruction had a greater increase in their library skills scores than the students who received an online tutorial without librarians’ facilitation (2002). Staff support and small group sessions do influence students’ mastery of information searching (Craig & Corral, 2007). However, caution needs to be exercised when applying the results of Churkovich and Oughtred’s (2002) study because it was a small study using a non-validated evaluation tool and the online tutorial provided no student-academia interaction, unlike the current study.

The effectiveness of e-learning for health professional education has been questioned by Cook et al. (2008) who conducted a meta-analysis. They concluded that, although e-learning is associated with large positive effects in comparison with no intervention, its effect in comparison with non-Internet instructional methods is heterogeneous and generally small.

It could be argued that a well-structured face-to-face instruction can effectively provide learning content to students, but whether the students learn skills from it is debatable. Comments made in the post-test focus groups in the current study indicate the significance of “experience” (learn by doing) and that it contributed to students’ learning (see page 143). The learning style preference of the participants in this study echoes the KALT assumptions that accumulating a growing reservoir of experiences creates a resource for learners (Knowles, 1970). The authors of several studies (Badke, 2008; Churkovich & Oughtred, 2002; Mery et al., 2012; Salisbury & Ellis, 2003) agree that a brief one-off instruction session without subsequent reinforcement offers inadequate support to students to help them successfully to master online searching. The web-enhanced approach provided in this current study provided more opportunities for students to build up their individual experience than the face-to-face instruction did, and the students’ comments indicate that the web-enhanced approach is more pertinent to their learning needs.

Learning expectation, styles, and needs of students are shaped by their life experiences, belief, and values (Billings, 2004). The findings of this current study
support Johnston’s (2010) conclusion that a technology-enhanced approach is an effective way for students to develop information literacy skills. Some students in the control group in the current study (see pp. 155-156) complained that they experienced information overload and could not recall the content conveyed by the librarian face-to-face. This is congruent with the finding of Holman’s (2000) study that reports students’ complaining about the pace of class instruction; participants in the experimental group (E2 and E10) in the current study expressed appreciation that they could be self-directed learners and have more opportunities to interact with the tutor and their peers through the intervention. Comments drawn from the control group participants during focus group discussions revealed that they were not satisfied with the teaching given and that they desired more hands-on exercises to be included in additional information literacy education.

Nkenke et al. (2012) found that incorporating technology, such as space-education, into education better matched dental students’ learning needs than face-to-face instruction alone. Incorporating technology has been associated with several beneficial effects in several studies: promoting students’ knowledge acquisition (Kerfoot et al., 2009); knowledge retention (Kerfoot et al., 2010); learning engagement (Nkenke et al., 2012; Shaw et al., 2011); and satisfaction (Nkenke et al., 2012). A multi-media intervention has been found to have advantages for inexperienced learners (Maag, 2004), and the use of an online forum, which provides students with additional interaction outside the classroom (Zumbach, Reimann, & Koch, 2006), appears to have stimulated students to spend more time on-task (Billings et al., 2005), thereby promoting students’ higher order thinking (Dunfee et al., 2008; Kenny, 2002). Similarly, technological multi-media elements were fundamental to the design of the current study and contributed to participants’ learning achievements. Such learning environments are in line with Knowles’ assumptions that adults learn best in a learning environment with rich supportive resources and facilitation from educators.

The self-paced learning package provided to the ADN students used technology to closely match their needs, acknowledging that students cannot master searching skills without subsequent reinforcement after a short face-to-face session, as indicated in other studies (Craig & Corrall, 2007; Mery et al., 2012; Salisbury & Ellis, 2003). The
intervention package used scenario-based videos and slides to teach the participants how to conduct online searches effectively; therefore, revisiting the self-paced online learning modules could be a factor resulting in the increase in the experimental group students’ information searching abilities and self-efficacy beliefs. This is consistent with Parsons’ (2007) study using online video clips. He found American community health preceptors’ self-efficacy beliefs significantly improved, thus supporting Bandura’s (1986) principle of strengthening learners’ self-efficacy and transmitting competencies through observing model performances.

Comments made by the participants in the experimental group indicate that using the online forum strengthened their critical thinking and reasoning skills (E19, page 170), which are both fundamental for information literacy. One participant, for example, reported that she had started to respond to other students’ postings with questions. This is consistent with the findings of previous studies (Dunfee et al., 2008; Meyer, 2003) that found the higher order thinking of undergraduate students in other non-nursing disciplines could be observed in the interactions occurring when they were using an electronic discussion board. According to Kenny (2002), the written nature of an online forum provides a more “thoughtful” environment, encouraging nursing students to consider their opinions before posting. Indeed, identifying keywords and constructing effective searching statements require the participants to exercise higher order thinking abilities such as problem solving, communication, and critical thinking (Lupton, 2004). Usual face-to-face instruction may or may not incorporate collaboration and group discussions. The limited time available is a factor, but if these activities are not incorporated this results in serious limitations. Activities that foster reasoning with other team members about whether to agree with or reject the choice of keywords, and that promote the use of problem solving abilities to identify appropriate search terms, all help foster students’ higher order thinking.

The experimental group participants commented that the online forum with the researcher’s timely feedback motivated their learning engagement and interest. This reinforces the previous studies by Billings, Skiba, and Connors (2005) and Buckley (2003) that report that nursing students spent more time on-task as a result of interactive online learning, which allowed these students to have additional interactions with peers and lecturers outside the classroom. Similarly, Zumbach,
Reimann, and Koch (2006) found that the use of online PBL was associated with more group interactions and collaborations than a face-to-face format. Although the sample sizes of Buckley’s (2003) study (each group was 24, 23, and 11, respectively) and Zumbach et al.’s (2006) study (N = 18) were small, and the students in the Zumbach et al. study were not in the nursing discipline, their findings, supported by the current study, suggest the usefulness of a technology-enhanced approach for improving students’ capacity to use databases. Most importantly, comments made by the participants highlight the importance of the facilitator’s participation in this online forum. Students engaged in this online forum more seriously because they knew the researcher was monitoring their discussions (see page 168), a finding that is consistent with previous studies (Lee, Mann, & Frank, 2010; Van Berkel & Dolmans, 2006).

In summary, the results of this study and other studies (Billings et al., 2005; Buckley, 2003; Dunfee et al., 2008; Meyer, 2003) suggest that the integration of an online self-paced learning package and a discussion board with facilitators’ timely feedback will better support the needs of students developing information literacy than will face-to-face instruction. Thus, a web-enhanced approach closely matching the ADN students’ (databases novices’) needs would support greater satisfaction, more engagement in learning, and higher self-efficacy levels about using databases.

### 6.3 Methods that nurture the participants' self-directed learning

#### 6.3.1 Participants’ readiness for self-directed learning

The results of the current study indicate that both groups demonstrated moderate self-directed learning readiness. They scored between 143.8 and 144.3 on the self-directed learning readiness scale for nursing education (SDLRSNE) (Fisher et al., 2001) before the information literacy education was introduced. The results are similar to those of Huang (2008) who reported in an unpublished doctoral thesis that Taiwanese nursing students (N = 195) enrolled in a two-year Bachelor of Nursing program had relatively high SDLRESNE scores (mean = 144.3, SD = 14.5)\(^{28}\), but the overall SDLRSNE

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\(^{28}\) Fisher, King, and Tague (2001), the developers of the SDLRSNE, proposed a high SDL threshold of 150.
scores of the participants were lower than the scores reported for Bachelor of Nursing students in other studies with small sample sizes. These studies found total SDLRSNE scores ranging from 150.6 to 154.7 for Bachelor of Nursing students in Australia (Fisher et al., 2001; Smedley, 2007), in Turkey (Kocaman et al., 2009), and in the People’s Republic of China (PRC) (Yuan et al., 2012). The majority of the two-year Bachelor of Nursing students in Taiwan are graduates of a five-year ADN program.

The lower scores of the participants in the current study are not unexpected as they are undertaking a lower level nursing program which has lower educational entrance requirements. The entry requirements for Bachelor of Nursing programs in Australia (Griffity University, n.d.) and in the PRC (Peking University School of Nursing, 2012) are to have a senior secondary qualification or equivalent alternative entry qualifications. In contrast, students beginning an associate degree program in Taiwan have completed three years of junior high school education, the equivalent of having completed year 9 or year 10 in Australia. These Taiwanese students are younger than the students enrolled in bachelor’s degree programs and this may have resulted in their being less prepared for tertiary study, as indicated by their moderate SDL scores. A study in Taiwan by Cheng, Kuo, Lin, and Lee-Hsieh (2010) also found a reduced ability in the area of SDL in this younger student group. Participants in the pre-test focus groups in the current study stated that they did not autonomously and regularly review information uploaded to the e-platform unless they were required to by the lecturer, which highlights their limited SDL. This and the findings of the current study suggest that, with the absence of adequate facilitation, ADN students in Taiwan may have limited capacity to become fully self-directed learners.

The finding that SDLRSNE scores were below the high SDL threshold of 150 suggests that better teaching strategies are required to improve the SDL of ADN students in Taiwan. Self-directed learning is the amount of responsibility that the learner accepts for their own learning (Fisher et al., 2001); the SDL stage of the participants in this current study falls between stage 2 and stage 3 of the stages described in Grow’s (1991) Stages in Learning Autonomy Model. Corresponding teaching styles that educators can use to support learners at stage 2 and stage 3 to advance to higher stages include a highly supportive approach, such as giving praise, and guided discussion and goal setting to reinforce interested and involved self-
directed learners’ willingness and enthusiasm to continue to learn on their own. Most importantly, Knowles et al. (2005) highlight that if SDL is necessary for students educators should make efforts to help learners transit from dependency to being self-directed.

### 6.3.2 Factors that influence learners’ self-directed learning

There was no statistically significant increase in the total SDLRSNE scores of either the control group (t = -.03, p = .98) or the experimental group (t = -.95, p = .35) after the intervention. The total pre-test (144.30) and post-test (144.26) SDLRSNE scores of the participants in the control group were very similar, while the experimental group’s scores improved slightly from 143.80 to 145.39. This indicates that the different teaching approaches used did not have an impact on the ADN students’ SDL readiness. The results are consistent with those of two previous studies that found Bachelor of Nursing students’ SDL did not significantly improve after an educational intervention (Wiley, 1983; Williams, 2004), but the qualitative findings from Williams’ (2004) study describe the students as having developed many characteristics associated with SDL, such as self-control of learning and sense of responsibility for and confidence about being a nurse, through PBL. These two small studies used a debatable questionnaire (developed by Gugliemino in the 1970s) and used participants in different countries undertaking different programs: Therefore, their quantitative results are not transferable to this current study, but the qualitative findings from Williams’ (2004) study and this current study both suggest that students’ SDL can be promoted using appropriate teaching strategies such as PBL.

In contrast, several other studies found a statistically significant increase in students’ SDL associated with PBL (Kocaman et al., 2009; Lee, Lin et al., 2010; Saha, 2006; Shankar et al., 2011; Tseng Hui-Chen 曾惠珍 et al., 2006). Knowles’ andragogy in practice model helps to explain the disagreement. KALT assumes that adults are independent and responsible for their learning when they perceive a life-related need to learn. But the characteristics of individual adult learners are influenced by both individual and situational differences, including different subject matter and situational differences (Knowles et al., 2005). Knowles and colleagues (2005) argue
that complex technique subject matter and unfamiliar content are more likely to
discourage learners’ self-directed learning. Adult learning transactions can be altered
by using different teaching/learning strategies, and by such broader level differences
as those in social-cultural contexts prior to and during the learning event (Knowles et
al., 2005). Finally, the learning process can be influenced by a number of individual
differences which may vary depending on the stage of adult development, cognitive
development, life-span-role development, and personality (Knowles et al., 2005).

Subject matter differences
The conflicting findings of the current study and other studies (Kocaman et al., 2009;
Lee, Lin et al., 2010; Saha, 2006; Shankar et al., 2011; Tseng Hui-Chen 曾惠珍 et al.,
2006) might be explained by the participants being unfamiliar with information
searching using library databases, and the complex concepts underlying the associated
advanced skills. Comments made by the participants in both groups reveal that they
had limited experience searching for information using the Airiti Library, and they
were unfamiliar with Boolean logic. Other studies also report that the use of Boolean
logic and limiters is conceptually complex for database beginners in the health
disciplines (Bronander et al., 2004; Majid et al., 2013; Salisbury & Ellis, 2003). This
phenomenon matches the explanation by Knowles et al. (2005) that individuals may
be less likely to behave in a self-directed manner when encountering new learning
content and complex technical subject matter. Similarly, Carcich and Rafti’s (2007)
study found that nurses with previous working experiences, who were newly hired in
a hospital, were poor self-directed learners in a self-learning nursing processes
orientation program. Moreover, Yuan, Williams, Fang, and Pang (2012) found that
the SDLRSNE scores of nursing students with relevant experiences, such as PBL and
SDL, were higher than those of students without such experience. As adult learning is
a transformation of experience, related experiences will contribute to changes in
individuals’ attitudes and behaviour (Hessig et al., 2004; Lamiani & Furey, 2009).
The findings of this study and others suggest that students’ SDL is influenced by
differences in learning content as described by Knowles et al. (2005).

Situational differences
The conflicting findings of the current study and other studies might be a result of different teaching/learning situations, including those in the PBL implementation (Kocaman et al., 2009; Lee, Lin et al., 2010; Tseng Hui-Chen 曾惠珍 et al., 2006) and learning settings (Saha, 2006; Shankar et al., 2011). For example, two studies (Tseng et al., 2006; and Lee et al., 2010) used a weekly face-to-face PBL format, thereby creating a learning environment where those undergraduate nursing students had more PBL experiences than the ADN students in the current study. Similarly, a whole PBL integrated nursing curriculum was used by Kocaman, Dicle, and Uğur (2009), which creates a learning atmosphere better for encouraging students’ SDL than the short period of PBL experienced by the students in the current study.

The results of this study suggest that a life-related learning situation is more beneficial for students’ SDL. Studies by Saha (2006) and by Shankar et al. (2011) found that SDL scores significantly increased after SDL and PBL. During their clinical practice sessions, the students were required to manage problems encountered each day more often than the participants in the current study. The idea that a life-related learning situation is more beneficial for students’ SDL is reinforced by other studies that successfully employed SDL strategies to support nurses’ professional development, for example, a self-directed learning manual (Mayer et al., 2005) and an online learning module (Schneiderman et al., 2009). A student in the experimental group commented that she taught herself to locate information using Google Scholar, which was included in the online self-learning package. Google Scholar was not included in the usual face-to-face instruction. Thus, long-term use in life-related settings, such as during clinical practice periods, may further benefit improvement of nursing students’ SDL.

**Learners’ individual differences**

The conflicting findings of the current study and other studies could be explained by the average age (18 years) of the ADN students, who were younger than the students in the other studies whose ages ranged between 19 and 28 (Kocaman et al., 2009; Lee, Lin et al., 2010; Saha, 2006; Shankar et al., 2011; Tseng Hui-Chen 曾惠珍 et al., 2006). An individual’s age will influence their cognitive development and learning preferences, and, as Knowles et al. (2005) highlight, individuals’ previously acquired
knowledge will act as filters shaping their practice of learning. Prior research has identified nursing students’ age as a factor related to their SDL (Kocaman et al., 2009; Malta et al., 2010; Smedley, 2007; Yuan et al., 2012). Mature nursing students are more likely to be self-directed learners who tend to see themselves in partnership with faculty (Davis & Schrader, 2009).

In summary, the lack of any significant improvement in the SDL scores of participants after the intervention in this study might have been caused by the complex and unfamiliar learning content, relatively brief online PBL, and being younger students than those in the previous studies (Kocaman et al., 2009; Lee, Lin et al., 2010; Saha, 2006; Shankar et al., 2011; Tseng Hui-Chen 曾惠珍 et al., 2006). Thus, the findings of this study and others support Knowles’ andragogy in practice model.

The next section discusses ADN students’ SDL being more likely to be stimulated using a web-enhanced approach informed by the principles of adult learning.

6.3.3 Encouraging participants’ self-directed learning

Comments made by the participants in the experimental group indicate that their learning motivation, sense of responsibility, and time management improved after the intervention, even though the quantitative data did not identify any statistically significant difference between the control and experimental groups in their total post-test SDLRSNE scores ($t = -.65, p = .52$). This is consistent with studies in the literature that describe the flexibility and convenience of e-learning as allowing students to learn in a self-paced manner (Crawford, 2011; Masalela, 2009; Mitchell et al., 2007). Nursing students became more active and responsible learners (Chen et al., 2009; Thiele, 2003) and self-paced learners of content (Salyers, 2005) after undertaking online format teaching. The findings of the current study and of the other studies suggest that SDL of nursing students can be improved using e-learning, although the other studies were conducted in other countries and did not use nursing students undertaking an associate degree. This supports Knowles et al.’s (2005) view that differences in teaching or learning strategies will influence learners’ SDL.
The current study indicates that a web-enhanced approach informed by KALT contributes to students’ SDL. This theory focuses on motivating students’ awareness of the need to know (what to learn, why to learn, and how to learn), life-related information, and becoming self-directed learners, by using experiential learning, such as group discussions and problem-solving activities (Knowles et al., 2005), instead of “the delivery of a bulk of learning content/information” (Shanahan, 2007, p.187). Comments made by students in the experimental group support the notion that this intervention effectively increased their awareness of “the need to know” and SDL (E19 and E24, see pp. 149-150). As Shanahan (2007) points out “Undergraduate education is undergoing a shift away from the traditional transmission of a fixed body of knowledge to a learning approach where the emphasis is on supporting learners to learn. Central to this change is recognition that undergraduate education programs should aim to develop independent learners who become effective lifelong learning practitioners” (p.187). This involves the teaching-learning paradigm shifting away from the traditional role of the instructor as a “sage on the stage”, who transmits a fixed body of knowledge (teacher-led or content-focus), to being a “facilitator” and providing learning resources where the emphasis is on supporting learners to learn (learner-centred or self-directed) (Mangold, 2007; Skiba & Barton, 2006).

This study found that the intervention successfully created a learning atmosphere that may have contributed to the increase in the experimental group participants’ SDL. Comments made by participants in that group indicate positive attitudes toward the intervention and enthusiasm arising from the interactions between their peers and the researcher. They consequently spent more time engaged in online learning, including online discussions. The findings are comparable to those of Chen, Stocker, Wang, Chung, and Chen’s (2009) study that describes post-registration nursing students’ online learning experience as a transition of responsibility from forming positive views to overcoming difficulties and engaging in self-reflection, and finally reaching an “enjoying online learning” stage. Similarly, Huang (2008) reports nursing students’ SDL and satisfaction being associated with adequate teacher-student interaction and timely feedback; and Billings et al. (2005) found that American postgraduate nursing students reported spending more time on their online learning course as compared to an on campus course. Furthermore, undergraduate nursing students enrolled in web-
based courses (Billings et al., 2005) felt more connections to their instructor and classmates when online discussions and emails with faculty were integrated.

Comments made by the experimental group students indicate an increase in their readiness for SDL similar to phenomena described in the literature, including an increase in self-management, self-control, responsibility, and motivation/desire for learning (Brookfield, 2009; Fisher et al., 2001; Garrison, 1997). The findings of the current study and other studies suggest that students’ sense of responsibility and engagement improved through the use of the intervention, although more mature nursing students participated in other studies. Overall, students’ SDL can be enhanced when they feel they are being supported and cared about. This reflects Knowles’ assumptions that a humanistic atmosphere will encourage individuals’ self-concept and their becoming responsible for their own leaning (Knowles et al., 2005).

On the other hand, the participants in the control group expressed negative attitudes during the post-test focus group discussions towards the use of e-platforms. They stated that they disliked the use of the e-platform in other courses because no teacher-and-student interaction or interaction with their peers was undertaken; there were only text-based postings by the lecturers, and students went online only when specifically instructed to do so. Several participants in the control group reacted passively toward the information provided by the lecturer. Their comments indicate that being given non-interactive information through an e-platform did not match these ADN students’ needs. One participant (C12, see page 170) criticised the use of e-platforms as just leading to the teachers becoming more distanced, putting material online and essentially demanding students look at it for themselves, rather than go through it together with the students. She suggested that teachers should change their teaching methods because using e-platforms is not benefiting students’ learning. Her comments reflect the statement by Levett-Jones (2005) that teachers would be viewed as not doing their job or abdicating their responsibilities if SDL and learners are not appropriately matched.

The findings of this study and other studies indicate that ignorance of adequate teacher-student interactions and of an appropriate educational theory to guide e-learning will reduce the effectiveness of technology-enhanced teaching to support students’ SDL. The results of this current study suggest the ADN students had limited
SDL readiness, unlike Bachelor of Nursing level students, and that lecturers’ feedback and group discussions are essential components of educational units to prepare ADN students for SDL.

6.4 Findings related to Knowles’ Adult Learning Theory

This section presents a brief summary discussing findings of this study related to Knowles’ Adult learning Theory in two aspects. The first aspect is that learners’ self-concept and motivation to learn can be influenced by situational differences such as different teaching strategies. This reflects the description of Knowles’ andragogy in practice model (2005) that situational differences act as filters that shape the practice of learning. The second aspect is that experiential learning and problem-solving learning match the ADN students’ needs and intrinsic motivators to engage in learning. The core assumptions of Knowles are supported as adult learners prefer collaboration and life-oriented learning.

Findings from the current research showed that the experimental group of participants in this study had significantly higher self-efficacy level, a greater desire for learning, possessed a sense of responsibility, and improved time management capability compared to the control group. Basically, ADN students in the experimental and control groups enrolled in the same course had similar educational backgrounds; however, the use of a web-enhanced approach contributed to the increase of students’ readiness for SDL and promoted their motivation to learn. This is consistent with previous studies that describe the flexibility and convenience of e-learning as allowing students to learn in a self-paced manner (Crawford, 2011; Masalela, 2009; Mitchell et al., 2007) experiencing a greater satisfaction when interacting with lecturers outside the classroom with the help of technology such as an online forum (Billings, et al., 2005; Buckley, 2003). The findings of this current research supports Knowles’ andragogy in practice model that describes the six core characteristics of adult learners can be influenced by variables in the middle layer such as differences in educational approaches and learning setting (Knowles et al., 2005). The facilitation of the lecturer during group discussion in this study also played a role in promoting adults’ active and responsible learning behaviour.
Results of this study show that there was a statistically significant increase in the online searching knowledge test (OSKT) and online searching skills test (OSST) scores of the participants in both groups after they received their education session/s. Literature suggests that a brief one-off instruction session without subsequent reinforcement offers inadequate support to students to help them successfully master online searching (Badke, 2008; Churkovich & Oughtred, 2002; Mery et al., 2012; Salisbury & Ellis, 2003). A structured group assignment was used for all students to master their searching skills in this course which supported the participants’ knowledge and skill acquisition.

Comments made in the post-test focus groups in the current study indicated the significance of “experience” (that is: learn by doing) and that it contributed to students’ learning (see page 143). The ADN students commented that the experience shared by the lecturer during group discussions really helped them in identifying appropriate keywords and the construction of effective search strategies (E22, see page 164). Group assignment is a useful strategy in promoting knowledge and skills, and the motivation of students (Cabrera, Crissman, Bernal, Nora, & Pascarella, 2002; Wyk, 2012; Zakaria, Chin, & Daud, 2010). It is reasonable to speculate that this may have been the case in the current sample of ADN students and highlights the important part that assessment plays in student learning. The findings are in keeping with KALT which emphasises that it is essential to use collaboration, group learning, and task-oriented learning such as problem-solving and project-based learning in promoting adult learning (Knowles et al., 2005). Therefore, Knowles’ assumptions for adult learners that their learning is based on prior experiences and problem-based group learning allowing for congruence with their learning preferences.

Results of this current research also found that adults’ learning will be optimised when they are respected and accepted by their lecturers. The experimental group showed a statistically significant increase in their self-efficacy scores that was not found in the control group. Comments made by a participant in the experimental group supported the statistical analyses and indicated that their self-confidence and learning engagement increased with the additional lecturer’s support. These findings concur with Grightmire’s study (2009) that found nursing students’ self-efficacy
beliefs in regards to their clinical skills were promoted when they felt supported and had a feeling of acceptance from their lecturers and staff in clinical settings. In addition, the researcher acted as a learning resource in supporting the participants to complete their assignment rather than merely the giving of instructions. The findings echo Knowles’ assumptions that a humanistic environment and intrinsic motivators such as self-esteem and self-actualisation contributes to adult learning.

6.5 Summary

The current study found that an intervention based on the principles of experiential and problem-solving learning, with timely feedback from the researcher when the participants completed group assignments, can strengthen the ADN students’ online searching self-efficacy to a statistically significant degree. The results are consistent with those of other studies investigating promoting students, nurses, and breast feeding women’s self-efficacy (Andrighetti et al., 2012; Mayer et al., 2005; McKenna et al., 2011; Noel-Weiss et al., 2006). The results from this current study and these previous studies support the principles of Knowles that education best suited for adult learners is problem-based, life-related, and based on previous experience. This study also identified the importance of being accepted and encouraged by the researcher during the student-researcher interactions when promoting the ADN students’ self-identity and self-efficacy. This is consistent with other studies found in the literature (Grightmire, 2009; Shepard, 2009) and with the humanistic learning atmosphere highlighted in KALK. The results of this study and other studies suggest that KALT is useful in guiding teaching methods to promote ADN students’ online searching self-efficacy.

This study supports the use of a mixed methods design as providing a better understanding of research problems than either quantitative or qualitative datasets used alone may achieve (Johnson & Onwuegbuzie, 2004). The quantitative data does not provide empirical evidence that this intervention has better teaching effectiveness for promoting the participants’ online searching knowledge and skills, or their SDL. This is similar to the findings of previous studies (Beile & Boote, 2004; Brettel & Raynor, 2013; Wiley, 1983; Williams, 2004). Nevertheless, comments made by
participants in the focus groups provide explanatory information illustrating how technology-incorporated teaching methods better match the needs of students, thus promoting the development of information literacy and SDL.

Comments made by participants in both groups confirm that learning by doing, with the assistance of technology, matches the learning needs of the participants who belong to the Net Generation (Mangold, 2007; Pardue & Morgan, 2008). Students in the control group encountered information overload and, most importantly, the brief face-to-face session lacked the exercise opportunities necessary for skills mastery, which has also been reported in previous studies (Badke, 2008; Dee & Stanley, 2005; Holman, 2000; Mery et al., 2012). In contrast, the experimental group participants in this study commented on several advantages and expressed greater satisfaction after experiencing the intervention. The flexibility of this self-paced online learning package with the option for them to revisit learning content benefited their skills mastery and their self-confidence. This is consistent with previous research (Parsons, 2007; Salyers, 2007). The written nature of the online forum and the researcher’s timely feedback forum appears to have contributed to an increase in the participants’ critical thinking abilities (Dunfee et al., 2008; Meyer, 2003). They helped these students to identify appropriate keywords and construct more effective searching statements, eventually effectively encouraging students’ online searching self-efficacy (Griffithmire, 2009).

The SDL scores of the experimental group students were higher than those of the control group after the intervention but the difference was not significant. Comments by the control group participants indicate that a teacher-led method without additional facilitation is more likely to discourage the participants from engaging in active and independent learning. In contrast, the experimental group participants’ comments made after the intervention indicate that, similarly to the results reported in other studies, they developed an awareness of self time management, spent more time on-task (Nkenke et al., 2012), had more student-teacher interaction out of the classroom (Billings et al., 2005; Buckley, 2003), and achieved higher readiness for SDL (Chen et al., 2009; Salyers, 2005; Thiele, 2003). The results of this study and others in the literature suggest that a web-enhanced approach guided by the principles of Knowles
offers students richer and more accessible learning resources that better match their learning needs than face-to-face instruction alone.

This study also found that the Taiwanese ADN students’ SDL readiness was approaching the high SDL score range defined by Fisher et al. (2001). The SDL scores of these ADN students are not as high as those of the Bachelor of Nursing students from various other countries (Fisher et al., 2001; Kocaman et al., 2009; Smedley, 2007; Yuan et al., 2012), but they are similar to the scores of the two-year Bachelor of Nursing students in Taiwan investigated in Huang’s (2008) study. The disparity between the findings of the current study and other studies, i.e. the ADN students’ lower SDL scores, could be caused by differences in the subject matter, in the learning situations, and/or the learners’ background, as outlined in Knowles’ andragogy in practice model. The results of this current study and Huang’s research suggest that lecturers preparing the ADN students to engage in SDL need to offer adequate facilitation, through collaboration, group assignments, online learning, and PBL. This should minimize the possibility of students having negative attitudes toward learner-centred strategies such as SDL and e-learning. The comments made about their experience by the control group participants in this study indicate this. The results of this study support Knowles et al.’s (2005) emphasis on the importance of adult educators to motivate students by giving them an awareness of the need to know before engaging in SDL.

The information literacy (OSKT, OSST, and OSSI) scores of all participants in this study all improved after instruction but were at a moderate level. All participants lacked the abilities to identify keywords and to integrate advanced searching skills into searching statements. This is similar to the findings of previous studies conducted with undergraduate students in both the nursing discipline and other disciplines (Chen Lin Ching 林菁, 2008; Craig & Corrall, 2007; Grant & Brettle, 2006; Salisbury & Ellis, 2003). The results suggest the need for further information literacy education in preparing ADN students’ for EBP.

Results of this study support a web-enhanced method guided by the principles of Knowles more closely matching the ADN students’ needs in developing information
literacy and readiness for SDL. A number of implications and recommendations for nursing education, research, and practice arising from the results of this current study are outlined in the Chapter 7.
Chapter 7: Conclusion

This chapter provides an overview of the research study and highlights its conclusions.

The purpose of this current research study is to identify the effectiveness of integrating e-learning into lessons addressing information literacy and self-directed learning (SDL) for Associate Degree in Nursing (ADN) students in Taiwan. The development of the intervention—a web-enhanced information literacy educational program—was based on the principles of Knowles’ Adult Learning Theory (KALT) and problem-based learning (PBL). Five research questions were designed to meet the research purpose and objectives.

A mixed methods intervention design was adopted to answer these research questions. The design consisted of a control and an experimental group, with focus group discussions and questionnaires both before and after the intervention period. The quantitative data included the participants’ information literacy in the areas of online searching knowledge, skills, and self-efficacy level, and their self-directedness for learning before and after the intervention period. The focus group discussions were used to provide supplementary information to help the understanding of the research interests.

This chapter highlights the contribution of results from this study and their implications. Recommendations for future directions in regards to the areas of nursing education, research, and practice, together with the limitations of this current study, are discussed.

7.1 Contribution of results

The main findings, contributions, and implications of this current research study in relation to the five research questions are summarized below.
Research question 1:
What was the level of the ‘online search knowledge’ of the control group and the experimental group before and after the intervention period?

Research question 2:
What was the level of the ‘online search skills’ of the control group and the experimental group before and after the intervention period?

The current study identified that Taiwanese ADN students’ information literacy in online searching knowledge and skills showed a statistically significant increase for all participants, irrespective of their status as a control or an experimental group member, after the intervention period. However, these students’ knowledge and skills scores fell in the middle range both before and after their instruction. In line with other studies with bachelor’s students, both the statistical data and the participants’ comments showed that they were weak in identifying keywords to find relevant information and unclear in selecting Boolean logic to promote their searching efficiency. This unique study provided information to reveal the gap in current information literacy education for these Taiwanese ADN students.

Implications:
These results reinforce the fact that ADN students’ online searching knowledge and skills need to be further promoted so that, from the outset, beginning learners are assisted to obtain sufficient searching skills for later informed professional practice. Therefore, further related education and a redevelopment in information literacy education for the ADN students are needed.

Research question 3:
What was the level of the ‘online search self-efficacy’ of the control group and the experimental group before and after the intervention period?

There was a significant improvement in the experimental group’s online searching self-efficacy inventory (OSSI) score ($t = -3.33, p = .001$) not seen in the control group. Comments from the experimental group participants showed that more knowledge and experiences in using databases and timely positive feedback from the researcher
contributed to the increase in their self-confidence in the specific skills. This is supported by a medium correlation between these ADN students’ self-efficacy levels and their online searching knowledge and skills. Results of this current study also indicate that the OSSI scores of the ADN students (both in the control and experimental groups) were neither high nor low but, rather, mid-range (6.05-6.64, range from 1 to 12) (Monoi et al., 2005). There was a statistically significant increase in the experimental group’s OSSI scores; but the increase is lower in comparison with undergraduate students in other disciplines (Monoi et al., 2005). Comments by the participants drawn from the pre-test focus groups showed that they primarily used Google and Yahoo for information searching before this (specific) semester; therefore, it is understandable that they had limited confidence in locating information using specialized field library databases. Results of this current study identify that timely feedback from teachers is a useful strategy in strengthening students’ self-efficacy beliefs. In addition, the increase in students’ online searching self-efficacy reflects their increase in knowledge and skills in this specific area.

Implications:
One implication from the results is that the emphasis on the use of library databases for information searching in preparing ADN students for evidence-based practice (EBP) should start in an earlier stage of this program. The small increase in the participants’ OSSI scores also suggests the need for information literacy education redevelopment in promoting these students’ online searching self-efficacy as mentioned earlier in relation to their knowledge and skills level. Correlation between students’ self-efficacy level and their knowledge and skills also suggests that the OSSI is a useful tool in measuring students’ learning outcomes.

Research question 4:
What was the level of the self-directed learning readiness of the control group and the experimental group before and after the intervention period?

The current research study found that the ADN students, neither in the control group nor in the experimental group, showed a statistically significant increase in their total Self-Directed Learning Readiness Scale for Nursing Education (SDLRSNE) scores after the intervention, although the experimental group’s scores showed a greater
increase than did the control group’s. The experimental group participants agreed that
a learning environment that provides a flexible learning format or that includes group
collaboration with adequate facilitation by the researcher was more likely to improve
their readiness for SDL. The SDLRSNE scores of all participants in this study fell in
moderate level irrespective of their status as a control or an experimental group
member both before and after their instruction when compared with other nursing
students enrolled in different programs, receiving PBL using different formats, and in
different learning settings. Results of this current research study supported by other
studies suggest that other factors, such as learners’ previous experience, age, learning
style preference, teaching strategies, and learning settings, rather than just the
Teaching approach, influence students’ SDL. Therefore, Knowles’ andragogy in
practice model, which assumes that SDL of learners may be influenced by individual
and situational differences, is reinforced. One important contribution of this current
study is that it provides baseline data for assessing Taiwanese ADN students’
readiness for SDL using a validated questionnaire.

**Implications:**
Results of this study suggest that this short period of online PBL could not effectively
improve the participants’ SDL; nevertheless, students’ awareness of SDL can be
enhanced by online PBL with timely feedback from lecturers. Results of the current
research study also suggest that students’ SDL is more likely to be promoted by a life-
related learning task. Therefore, PBL during clinical practice, a flexible learning
format, and group collaboration with adequate facilitation by lecturers are useful
strategies in preparing ADN students to be self-directed learners.

**Research question 5:**
What was the effect of an educational intervention on the online search knowledge,
skills, self-efficacy, and self-directed learning readiness of ADN students in the
intervention cohort compared to ADN students who received usual instruction?

The experimental group in this study showed a statistically significant increase not
demonstrated by the control group in the OSSI scores after receiving their education (t
= 2.19, p = .027). The control group participants commented that they experienced
information overload and felt the lack of hands-on exercises during their short face-to-
face instruction session. They also reported negative experiences related to face-to-face group discussion during the absence of teachers, and previous e-learning experiences with insufficient preparation in support of their SDL. In contrast with the above, this study found that the intervention enabled participants in the experimental group to have the freedom and self-management to join online group discussions and to revisit the online learning package over and over again until they mastered their online searching skills. They also acknowledged that the use of the online forum enabled them to receive timely feedback from the researcher. In particular, based on the principles of adult learning, the researcher successfully created an online learning environment that stimulated the participants’ sense of responsibility, desire for learning, and engagement (Knowles et al., 2005).

Results of this study confirm a web-enhanced approach guided by the principles of Knowles closely met the ADN students’ learning needs in developing information literacy and preparing them for SDL in comparison with other students who received the usual face-to-face instruction alone. Results of this study further validate the strength of mixed methods research (Creswell & Plano Clark, 2011).

**Implications:**
Activities which foster deep learning and student-centred learning approaches should be incorporated into information literacy education. Comments of students in the focus groups indicate that deeper learning occurred when they experienced the problem-based online forum during the intervention period. The implication is that KALT is a suitable framework to guide the teaching of information literacy for nursing students because the KALT principles reflect the needs of students to develop critical thinking and problem-solving skills, such as exploration and analysis of keywords, and their judgment about whether information that they retrieve is relevant. Results of this study also highlight the necessity for teachers to participate in these activities in preparing ADN students for SDL, such as through group discussions, PBL, and e-learning.
7.2 Future directions

In order to improve nursing education, related research, and clinical practice in the areas of information literacy and SDL in Taiwan, several recommendations supported by the results of this study are proposed.

7.1.1 Recommendations for nursing education

The knowledge gained from this study provides evidence to support the redevelopment of information literacy education for the ADN students in Taiwan. In order to effectively develop Taiwanese ADN students’ online searching skills for their EBP, three recommendations are proposed:

- Integrating information literacy education into the whole nursing curriculum across five years instead of in one embedded course. This training should start earlier in the associate degree program to offer students more practice opportunities to gain mastery in the required skills. Experiential learning using hands-on exercises is particularly suggested.

- Using teaching strategies guided by the principles of Knowles to promote the ADN students’ searching skills in using databases. Group projects, PBL, and discussions are useful but the participation of lecturers is required in facilitate students’ SDL. Students’ problems related to online searching, including identifying synonyms and applying advanced searching skills, can be solved with timely feedback from experienced users. This feedback can be offered either in face-to-face or online format; but the latter has greater flexibility and accessibility.

- Incorporating a web-enhanced approach, which offers students richness and accessibility to learning resources that are crucial for effective learning (Knowles et al., 2005). A self-paced online learning module with films is one example.
7.1.2 Recommendations for nursing research

Three recommendations for future nursing research are drawn from results of this
current study:

- A longitudinal, repeatedly measured study focusing on nursing students
  enrolled in a whole program with PBL integrated is more appropriate in
  examining the long-term effect of using the strategy on students’ SDL. In
  addition, participants recruited from different nursing programs and
  learning settings can be used as comparison groups to identify the influence
  of individual differences and situational differences in students’ SDL
  improvement.

- A mixed methods design is recommended for further study in evaluating the
  effect of innovative teaching strategies. This design provided both
  quantitative and qualitative data allowing the researcher and reader to gain a
  more comprehensive understanding of the research problems and possible
  solutions (Creswell & Plano Clark, 2011).

- A validation of the two translated questionnaires in a Taiwan nursing
  student context is recommended. To reiterate, these questionnaires are the
  OSSI by Monoi, O’Hanlon, and Diaz (2005), and the SDLRSNE by Fisher,
  King, and Tague (2001). Taiwanese ADN students in the current study
  showed a lower score increase after education, as measured using these two
  questionnaires, when compared to the results from other studies that
  involved undergraduate students in a Caucasian context. Hence, a further
  study that involves a large sample size of Taiwanese nursing students from
  other nursing programs is required to confirm the appropriateness of these
  two translated questionnaires.

7.1.3 Recommendations for nursing practice

There is now evidence indicating that students’ information literacy improves over
time by using case-based group collaboration through online discussions with the
researcher’s feedback. It is recommended that hospitals in Taiwan can apply an e-
tutorial with group discussions facilitated by experienced database users as a teaching
strategy for continuing professional development in strengthening nurses’ online

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searching skills. This will enhance patient safety and the quality of nursing care in Taiwan, as effective information searching skills are a fundamental requirement for EBP. This kind of e-learning also offers nursing professionals the benefit of being literate consumers of information in an electronic environment.

7.3 Strengths and limitations

This unique study provided important insights into nursing education in Taiwan. It was the first study to examine the effectiveness of Knowles’ teaching approaches through focusing on ADN students in Taiwan. Previous studies have indicated the effectiveness of KALT in improving nurses’/students’ nursing competencies and learning satisfaction in Canada, the USA, and other Western culture countries. However, it was not known if the same positive outcomes would be found in the Asian culture of Taiwan. Results of the current research fill the gap and support the usefulness of KALT in a Taiwanese nursing education context.

Some methodological limitations existed in the current research due to several practical issues. The researcher was not able to randomly to allocate individual participants because the educational intervention was integrated into one nursing course in the fourth year. Four classes of the ADN students enrolled in this course thus were randomly drawn from six classes then allocated in groups using a cluster randomization. The sample size for a cluster randomization sampling may not have been sufficiently for generalization, being limited by the unavailability of more classes. However, choosing randomization by class group reduced the potential for treatment contamination amongst participants. Furthermore, this mixed methods design countered such limitations and provided insightful information that strengthened the quantitative findings and answered the research questions using the participants own voice to explain “what change” and “what caused the change” in these participants’ information literacy and SDL.

The current research study design did not include a long-term follow-up test to measure participants’ knowledge retention. However, the current research evaluated the participants’ online searching self-efficacy, which is accepted as an effective
predictor for future performance. The increase in self-efficacy after education also reflects the higher level of learner satisfaction and motivation.

The length of this intervention was confined logistically as the intervention was embedded in a single course of one semester’s duration. This length of time may prove to be too short for the students to move to a significantly higher level of SDL. The results of this current study suggest that an entire PBL-integrated curriculum should have more impact on students’ SDL improvement because individuals’ readiness for SDL appears in a continuum (Fisher et al., 2001; Knowles et al., 2005).

A broader application of the current study’s findings should be undertaken with caution. This study focused only on Taiwanese ADN students’ information searching experiences and measures using two researcher-developed knowledge and skills tests. Although face and content validity of the two tests had been established, the tests may not be a suitable tool for Bachelor of Nursing students in Taiwan or other countries.

7.4 Summary

This current study identified that KALT is useful in informing teaching strategies that promote Taiwanese ADN students’ information literacy and SDL. KALT principles are culturally transferable; in particular, experiential, life-oriented, and problem-solving learning will augment the ADN students’ SDL and learning satisfaction. Thus, learner-centred approaches, such as project-based assignments and experiential learning, can offer students more hands-on opportunities to develop knowledge and skills through solving problems that the students may encounter in their real nursing practice. Therefore, it is recommended that KALT can be used broadly across Taiwan amongst nursing schools to develop students’ information literacy and SDL.

The current research documented the online searching knowledge, skills, self-efficacy, and SDL levels of the ADN students in Taiwan before and after a course instruction with and without intervention. The results provide the foundation for future studies related to the outcomes of this current study. In addition, results of this study answered the research questions and are consistent with the conceptual framework.
The results of this study suggest that a web-enhanced approach offers students richer and more accessible learning resources that better match their learning needs than face-to-face instruction alone. However, this study also suggests a need for information literacy education redevelopment for Taiwanese ADN students in preparing them for EBP. This training should start earlier and across this five-year program; integrated with e-learning and with timely feedback from lecturers. The ADN students’ SDL was approaching the higher score end of SDL; therefore, adequate teacher presence is required when student-centred learning activities, such as group assignments, PBL, and online learning, are featured in their learning.

Overall, the results of this current research study support the use of learner-centred, collaborative, and problem-orientated principles proposed by Knowles (1990) with a web-enhanced education method to promote Taiwanese ADN students’ online searching knowledge, skills, self-efficacy, and their SDL. Collectively these prepare ADN students for their active engagement in evidence-based nursing practice.
Appendices

Appendix 1: Research ethics approval

GRiffith UniveRsity HumAIn ReSeArCh etHICs COmmItee

17-May-2011

Dear Mrs Tsai

I write further to the additional information provided in relation to the conditional approval granted to your application for ethical clearance for your project "NR: Web-enhanced education addressing online searching of academic databases in Associate Degree of Nursing students in Taiwan" (GU Ref No: NRS/16/11/HREC).

This is to confirm receipt of the remaining required information, assurances or amendments to this protocol.

Consequently, I reconfirm my earlier advice that you are authorised to immediately commence this research on this basis.

The standard conditions of approval attached to our previous correspondence about this protocol continue to apply.

Regards

Gary Allen
Manager, Research Ethics
Office for Research
G39 room 3.55 Gold Coast Campus
Griffith University
ph: 3735 5585
fax: 5552 9058
email: g.allen@griffith.edu.au
web:
Certificate of IRB Approval

To

The study listed below has been reviewed by the Institutional Review Board (IRB) of this University and approved on April.11.2011 with the approval number of IRS#: 99-IRB-018

Study Protocol:

(3t) The effects of web enhanced education addressing online searching of nursing databases for Associate Bachelor of Nursing students in Taiwan.

(中文) 網路補助教學對護理科學生的網路資料搜尋技巧教學成效探討

Principal Investigator:

(3t) Tsai, Ling-Chun

(中文) 蔡玲君

Chairman of Committee of IRB
Meiho University
Ping Tung, Taiwan

The approval of the institute, in which the research will be performed, is also required before the conduction of this research.
Appendix 2: Information sheet and consent form

Information sheet: English version

Title: The effectiveness of web-enhanced self-directed learning in promoting information literacy of nursing students in Taiwan.

This research project investigating an experimental group of Taiwanese Associate Degree in Nursing students has been developed by chief investigator, Mrs. Tsai Ling-Chun, School of Nursing and Midwifery at Griffith University, Queensland (Tel: +886-7-338-21571), and supervised by Professor Judy Wollin, School of Nursing and Midwifery at Griffith University (Tel: +61-7-338-21470) and Dr. Ursula Kellett, School of Nursing and Midwifery at Griffith University (Tel: +61-7-373-55227).

Background
In a modern Internet computer society, information searching skills are the basis for individuals to be lifelong learners and competitive in their careers.

Information searching skills are an essential competency for nurses since evidence-based practice (EBP), which promotes quality care and patient safety, is the gold-standard in nursing. Effective information seeking skills are based on the problem-solving abilities of individuals. As nursing educators, the researchers aim to develop a more effective approach to assist nursing students to develop and enhance their information seeking skills in this technological information age. Therefore, this study has been proposed to test the effects of web-enhanced education addressing online searching of nursing databases.

What participation in this study involves
Participation in this study requires you to complete a questionnaire about your online searching skills and learning experiences. The questionnaire will take you
approximately 30 minutes to complete. Moreover, you are asked to give your permission for us to access your academic records to obtain information about your learning performance in computer, English, and case study courses.

Some participants will be asked to join self-paced online learning activities for a period of four weeks. Furthermore, those participants will be requested to join a group interview, which may last 60 to 90 minutes; the interview will be taped.

**Consent of participants**

Your participation in the study is voluntary; you are not under any obligation to consent to participate in this project. (If you are under 17 years of age, please pass this information sheet to your parent or guardian to seek their permission for you to join this study.) Non-participation will not involve any penalty nor affect any current or future academic grades. If you chose to participate, you may withdraw at any time without penalty and without providing an explanation.

We hope that you will consider participation in this study which, while it may not benefit you directly, may have the potential to improve the learning effects of online searching skills of nursing students in Junior College Associate Degree in Nursing programs.

**Risks and discomforts**

The only risk associated with participating in this study is that the completion of the questionnaire and participation in the self-paced online learning activities and group discussions will take additional study time. However, all the research related activities will be undertaken on the Meiho University campus and will be arranged at times following scheduled classes.

You are free to withdraw from the study if you are uncomfortable engaging in online learning activities. Also, you may decline to answer any question in the questionnaire or group interviews if you so desire.
Confidentiality
The data collected from this research will be reported in general terms and will not involve any personal identifying features. A code number or a pseudonym will be used instead of your name. All data, including audio records, will be kept confidential and in a locked filing cabinet held by the researcher for five years after the conclusion of the current research study, then erased as soon as possible. No individual other than the author may access the data.

Complaints mechanism
If you have any questions about this present study, Mrs. Ling-Chun Tsai will be happy to answer them. Griffith University conducts research in accordance with the (Australian) National Statement on Ethical Conduct in Research Involving Humans. If you have any concerns or complaints about the ethical conduct of the research project you should contact the Manager, Research Ethics at Griffith University, Queensland (+61-7-387-55585 or research-ethics@griffith.edu.au) or Associate Professor Mei-Yo Ho at Nursing Department, Meiho University (08-7799821 ext 8347 or x00002010@meoho.edu.tw), and she will contact the Griffith University Human Research Ethics Committee on your behalf.

Privacy statement
Your involvement in this study does not involve the collection, access, or use of your personal information except academic records of the courses related to information literacy.

Griffith University thanks you for your consent and participation in this project.
參加者說明書

研究主題：網路輔助教學對護理科學生的網路資料搜尋技巧教學成效探討

親愛的同學/家長:
首先，謝謝您撥冗閱讀此說明書。有鑑於在網絡科技的時代中，資訊搜尋技巧是個人終生學習與提高職場競爭力的必備能力。專業的資訊尋求更是提高護理品質與增加病人安全不可獲缺的，研究者本著多年教學的熱忱，期望能發展出更有成效的教學方式來培養護專學生的資訊搜尋技巧，尤其是專業的資訊。故提出這一個網路輔助教學對護理科學生資訊搜尋技巧成效的研究。

參加者參與研究之說明
參與這個研究的所有學生，將被邀請於資訊搜尋技巧教學之前與之後填寫關於網路資訊搜尋的技能與學習經驗的問卷，完成這個問卷約需四十五分鐘。此外，研究者將要求您的許可去查閱您在電腦概論(實習)(一)、(二)及個案護理等課程的學期成績。

有些參與本研究的學生，將被邀請來參與一個為期四週的自我網路輔助學習活動、網路小組討論以及面對面小組教學活動。少部分參與本研究的同學生，在接受資訊搜尋技巧教學之後，將被邀請來參與小組會談，其目的是分享個人之網路及專業資料庫搜尋技巧的學習經驗與需要。每次小組會談約60至90分鐘，每組約有十二名學生，談話的內容將以錄音方式保存。

自願參與研究權利
您可自主決定是否參加這個研究(但是若您未滿17歲，須經父或母親同意才可加入本研究，所以請將此說明書轉送給您的父母)。您可隨時停止參與這個研究而不用擔心受罰或解釋理由，並且不論參與本研究與否，均不會影響您在本課程的學習成績。誠摯的邀請您參與本研究，或許您未能獲得即刻的好處但您的參與可幫助其他的專科護理學生，在未來獲得較佳的網路資訊搜尋學習。

危險或不適產生時的處理
只是參與這個研究，會使用到您的課外時間，例如，填寫問卷、接受小組會談、參與網路自學活動、討論及面對面的小組教學。只是這些與研究有關的活動，均將安排在你的課外活動時間。如：自習課或課後時間，並且避免在您高度學
習壓力時段，如期中考或期末考週，並且為顧及您交通的方便與安全性，小組討論及填寫問卷的地點，均安排在美和科技大學的校園內。

您可隨時終止參與本研究所提供的網路輔助學習活動或，不回答問卷或訪談的問題，無須擔憂任何刑罰且無須解釋原因若您有任何相關的學習問題，研究者亦可協助轉介到學校相關人員，協助處理您的學習困擾。

隱私保障
您的名字，不會被標示出來，因此個人的隱私不會因本研究的相關報導被暴露。再者您所填寫的問卷及訪談的錄音或錄影內容，除研究者之外，他人未經您的同意，將無法取得這些資料。除了自我導向學習準備度量表的原始資料，將以無記名的方式送至該量表的原始作者。作為建構該量表的信效度資料庫。所有資料將被妥善保存五年，並且在完成研究的相關報告後將被盡速銷燬。

申訴機制
若您有任何研究，本人蔡玲君很高興能為您說明。若在參與研究之後，有任何因本研究導致的不舒服、受損，您可向格里菲斯大學倫理研究委員會反映(+61-7-387-55585 或 research-ethics@griffith.edu.au)或連絡美和科技大學護理系何美瑤老師(08-7799821 轉 8347 或 x00002010@meiho.edu.tw)。他將代為反映。

最後，參與這個研究並不會收集或使用你個人隱私的資料。若您同意參與本研究，請在次頁的參與研究同意書簽名處，簽上您的大名。

格理菲斯大學謝謝您參與本研究
主要研究人員:
蔡玲君
電話 0916011951 或+61-7-33821571
澳洲格理菲斯大學博士候選人；美和科技大學護理系講師

指導教授:
Judy Wollin 教授 澳洲格理菲斯大學 (+61-7-338-21471)
Ursula Kellett 博士 澳洲格理菲斯大學 (+61-7-373-55227)
Consent form: English version

Title: The effects of web-enhanced education addressing online searching of nursing databases for Taiwanese associate degree in nursing students.

Chief investigator:
Mrs Tsai Ling-Chun  
E-mail: j.tsai@griffith.edu.au  
Tel: +61-7-338-21571  
School of Nursing and Midwifery, Griffith University, Queensland

Supervisors:  
Professor Judy Wollin  
Tel: +61-7-338-21470  
School of Nursing and Midwifery, Griffith University, Queensland

Dr. Ursula Kellett  
Tel: +61-7-373-55227  
School of Nursing and Midwifery, Griffith University, Queensland

I have read the information sheet and understand that:

- This study is to investigate the effects of different educational approaches in online searching skills.

- I am being asked to complete a questionnaire before and after receiving online searching education.

- I am asked to give my consent for the researchers to look up my academic scores in Computer Skill and Case Study Discussion in Nursing courses. However, the researcher will use a code number to ensure my individual information remains confidential and anonymous.

- I might be asked to participate in a period of four weeks of self-paced online learning activities.

- I might be asked to join a group discussion before and after receiving online searching education.

- My participation is voluntary and I may discontinue my participation at any time without any penalty or explanation.
• Any reports or publications from this study will be reported in general terms and will not involve any personal identifying features.

• The data, including audio records, will be kept confidential at all times and in a locked filing cabinet held by the chief researcher for a period of five years before being destroyed.

I have read the information sheet and consent form. I agree to participate in this study and give my consent freely. I understand that the study will be carried out as described in the information statement, a copy of which I have obtained. I realize that whether or not I decide to participate is my right and that non-participation will not harm my learning and academic scores. I also understand that I can withdraw from this project at any time without providing any reason. I have had all my questions answered to my satisfaction.

Name and signature ___________________________ Date __________________
研究同意書

研究主題：
網路輔助教學對護理科學生的網路資料搜尋技巧教學成效探討

主要研究人員：
蔡玲君
E-mail: j.tsai@griffith.edu.au
Tel: +61-7-338-21571
澳洲格理菲斯大學博士候選人/美和科技大學護理系講師）

指導教授：
Judy Wollin 教授 (格理菲斯大學)
Ursula Kellett 博士 (格理菲斯大學)

參加者的聲明：我已經閱讀過研究說明書並且了解

- 這是一項探討不同學習方式對學生網路資訊搜尋技巧成效的研究
- 我將會在接受網路資訊搜尋技巧教學之前與之後各填寫問卷一次
- 我被要求許可研究者查詢我的電腦概論(實習)(一)、(二)及個案研究的學期成績
- 我可能被邀請去參加為期四週的自我網路輔助學習活動，包括面對面的小組教學，參與網路自學活動及網路小組討論
- 在接受網路資訊搜尋技巧教學之後，我可能被邀請去參加小組的會談(60-90分鐘)，且知道將以錄影(音)的方式紀錄談話的內容
- 我是自願參加這個研究的，並且知道我可隨時停止參與這個研究，不用擔心受罰或解釋理由
- 我的個人隱私不會因本研究的相關報導被暴露
- 所有的資料將被妥善保存五年，除研究者外他人無法取得
經閱讀說明書與同意書後，我同意參加此項研究計畫，並且我已收到一份研究說明書。我也了解無論參與或不參與這個研究均不影響我在學校的正規學習，並且知道我是可以隨時停止參與這個研究，無須任何理由。當研究發表時我知道，我的名字是被保護的，不會出現於公開場合。在簽此同意書前我有機會發問並了解研究中可能發生的狀況。研究者已詳盡為我解釋並有時間讓我考慮。我也被告知，參與本研究沒有利益性的回饋，若我有因研究導致的不舒服、受損，可向格里菲斯大學倫理研究委員會反映(電話 +61-7-387-55585 或 research-ethics@griﬃth.edu.au)或連絡美和科技大學何美瑤老師代為反映(電話 08-7799821 轉 834 或 x00002010@meiho.edu.tw)。

簽名：____________________ 日期：____________________
Appendix 3: Permission to use questionnaires

PERMISSION TO USE THE ONLINE SEARCHING SELF-EFFICACY INVENTORY

收件人: Julia Tsai <j.tsai@griffith.edu.au>

寄件人: "Nancy O'Hanlon"

傳送自: olanlon.1@gmail.com

日期: 01/10/2011 11:28 下午

副本抄送: diaz.28@osu.edu, Judy Wollin <J.Wollin@griffith.edu.au>, Ursula Kellett <U.Kellett@griffith.edu.au>

主旨: Re: asking for permission --OSS Inventory

Julia,

You have our permission to use this scale in your research, as long as original author credit is maintained on your translation. The URL has changed, but the Inventory can still be found at:

http://liblearn.osu.edu/courses/OSS_Inventory.pdf

There is no manual for this scale.

Best wishes,
Nancy O'Hanlon

Nancy O'Hanlon
Professor; Interim Assistant Director for Collections, Instruction, & Public Services
The Ohio State University Libraries
305G Thompson Library
1858 Neil Ave. Mall
Columbus, OH 43210-1286
Tel: 614-688-5707 / Fax: 614-292-7859
PERMISSION TO USE THE SELF-DIRECTED LEARNING READINESS SCALE FOR NURSE EDUCATION

FROM: Murray Fisher, DipAppSc, BSc, MHPEd.
Lecturer
Faculty of Nursing
University of Sydney
mfisher@nursing.usyd.edu.au

RE: Use of the Self-Directed Learning Readiness Scale for Nurse Education

You are free to use the Self-Directed Learning Readiness Scale for Nurse Education for your research. The instrument is copyrighted (c. 2001, Fisher, King & Tague) and may not be duplicated or copied without first submitting a signed copy of this permission form to M Fisher. Requests for any changes or alterations to the instrument should be made in writing to M Fisher. As with all revisions, the copyright will be retained by Fisher, King & Tague and must appear on the printed copies of the instrument.

By filling in your name, address, phone number, and e-mail address and signing the agreement use below and mailing it to M Fisher, you are hereby given permission to use the Self-Directed Learning Readiness Scale for Nurse Education for your research. The permission is valid only for the study named below.

Fisher, King & Tague requests that you send back the following information:
- your raw data in ASCII format for our reliability and validity bank
- copies of any changes or translations of the scale
- copies of any publications citing the use of the scale

When using the Self-Directed Learning Readiness Scale for Nurse Education you need to use the following reference:

Appendix 4: Research questionnaires

Part 1: Research demographic form

<table>
<thead>
<tr>
<th>Name: ___________________</th>
<th>Student number: __________________</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coding number: ___________</td>
<td></td>
</tr>
<tr>
<td>Birthday: <em><strong>/</strong></em>/_______ (day/month/year)</td>
<td></td>
</tr>
<tr>
<td>Gender: □ male □ female</td>
<td></td>
</tr>
<tr>
<td>E-mail address: ________________</td>
<td></td>
</tr>
<tr>
<td>Contact phone number: __________________</td>
<td></td>
</tr>
</tbody>
</table>

Please answer below items based on your real experience.

1. I have previous web-enhanced learning experience. □ Yes □ No

2. I have relevant learning experience about “how to search information using Chinese electronic databases.” □ Yes □

   If you ticked Yes, please note the length of learning time.
   □ Less than 30 min □ about 1 hr □ about 2 hrs □ about 3 hrs □ more than 4 hrs

3. I have relevant learning experience about “how to search information using English electronic databases.” □ Yes □

   If you ticked Yes, please note the length of learning time.
   □ Less than 30 min □ about 1 hr □ about 2 hrs □ about 3 hrs □ more than 4 hrs
Please answer the questions based on your real experience in the latest 6 months.

**Instruction:**
There is no right or wrong answer. Please rate ✓ each statement according to the degree to which you agree with it. The higher the score the more you agree with this statement. For example: 5=always; 1=not at all.

<table>
<thead>
<tr>
<th></th>
<th>Always</th>
<th>Often</th>
<th>Neutral</th>
<th>Seldom</th>
<th>Not.at.all</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>2.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>4.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>5.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>6.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>7.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>9.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>10.</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>
### Part 2: Online Searching Knowledge Test (OSKT)

The following 16 questions are designed to assess your online information searching knowledge level.

<table>
<thead>
<tr>
<th>Instruction: Please read each statement and circle the most appropriate response.</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Which database would you use to search and download a nursing journal article with full text?</td>
<td>A. CEPS</td>
<td>B. Taiwan Journal Articles Image system</td>
</tr>
<tr>
<td>2. Which approach is best for you in searching information concerning the statistics for the birth rate of newborns in Taiwan?</td>
<td>A. Yahoo engine</td>
<td>B. Electronic Thesis &amp; Dissertations System</td>
</tr>
<tr>
<td>4. Which set below is best for you to locate information directly about the side effects of chemotherapy experienced by leukaemia patients?</td>
<td>A. (leukaemia OR chemotherapy)</td>
<td>B. (leukaemia AND chemotherapy)</td>
</tr>
<tr>
<td>5. Which sentence below did not underline the main concepts (keywords) of the title?</td>
<td>A. How to assist participants coping with the change in their body image after a colostomy surgery?</td>
<td>B. The self-care behaviour of diabetic patients.</td>
</tr>
<tr>
<td>6. Which set below best represents the main concepts in the following sentence “how to assist the mother to cope with the loss and grief concerning the death of their child due to brain cancer”?</td>
<td>A. Cancer and grief</td>
<td>B. Lost and coping</td>
</tr>
<tr>
<td>7. Which set below best represents the main concepts in the following sentence “What are the health risks to women athletes who use anabolic steroids”?</td>
<td>A. Women, females, drugs</td>
<td>B. Women athletes, health risks, steroids</td>
</tr>
<tr>
<td>8. What is the truncation symbol used in the Taiwan Journal Articles Image system to locate variants of search words such as “teach,” “teacher,” and “teaching”?</td>
<td>A. !</td>
<td>B. *</td>
</tr>
<tr>
<td>9. What is truncation?</td>
<td>A. Searches for variant endings to a word.</td>
<td>B. Means that two words have to occur beside each other.</td>
</tr>
<tr>
<td>10. In the following three options, which is a more effective strategy to retrieve the article “Ku, Y.-L., Sheu, S., &amp; Kuo, S.-M. (2007). Efficacy of Integrating Information Literacy Education Into a Women’s Health Course on Information Literacy for RN BSN Students. Journal of Nursing Research 15(1), 67-77.”?</td>
<td>A. Combined</td>
<td></td>
</tr>
</tbody>
</table>
search with author and date  B. Using Boolean operators and keywords, such as: education AND nursing  C. Using field search, such as limiting it to author and title of journal.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>11. Which is the best searching strategy to locate “breast feeding in adult women”?  A. Breast feeding AND infant  B. (Breast feeding NOT adolescent) AND infant  C. (Women OR breast feeding) AND infant.</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>12. Which is the best next step for you in reducing the number of retrieved articles when you used “health care” as a search term that resulted in 232 articles?  A. Add more keywords  B. Find relevant articles through title reading  C. Change search term as “health” and search again.</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>13. Which of the following is not appropriate for you to use in retrieving information for your academic assignment?  A. Google engine  B. Taiwan Journal Articles Image system  C. CEPS.</td>
<td>A</td>
<td>B</td>
</tr>
<tr>
<td>14. Which approach enables you to obtain a copy of a specific article from a library database such as Airiti Library?  A. Yahoo search  B. Taiwan Journal Articles Image system  C. Nationwide document delivery service (NDDS).</td>
<td>A</td>
<td>B</td>
</tr>
</tbody>
</table>

Instruction: 
Please read each statement and circle the most appropriate response.
Part 3: Online Searching Skills Test (OSST)

Instruction:
Please use library resources to complete this test. The evaluation of this skills test is based on the results of your authentic online searching performance. The more searching techniques used the higher the scores will be. These techniques include the use of combined searches, Boolean operators, fields, and reasonable searching results.

Question 1:
Please download the following article through the use of the Internet: Ying-Ying Chang and Man-His Wang (2008). Subjective nursing competence and the related factors of nurses in a medical centre. VGH Nursing, 25(4), 334-341.

(1) Please write down the procedure describing how you located this article.

(2) Please download this article and save it on the screen of the computer in front of you. If you are not able to conduct this task please tick here (____), and then continue to answer question 2.

Scenario:
Mrs Lee was a 45 year old divorced mother. She was a fashion designer. Three months ago, a small lump was found in her right breast. It was diagnosed as having a malignancy after a series of examinations. Thus, she was admitted into hospital and was going to receive right breast reconstructive surgery.

Nurses realised that Mrs Lee had lived overseas for a long period of time. She was advanced as a designer and was a perseverant single mother. However, this unexpected situation distressed her. Before the date of her surgery, as her primary nurse, you noticed that Mrs Lee often wept and sighed when she was alone. She said to another nurse that she was not able to cope with such a change in her life. As she stated “I only came to hospital for further examinations and did not grant this small lump would become a serious problem.”

Post-surgery, the nurse noticed that Mrs Lee avoided looking at her wound while she was changing the wound dressing. During that period of time, Mrs Lee repeatedly asked nurses and doctors the same question “Does my right breast look good?” She was uncomfortable about a different sensation between her two breasts. Before her discharge, she complained to the nurses that she felt that there was a difference in
appearance between her breasts. “Is it strange to you if you can tell the difference in appearance of my breasts?” “I am afraid that I will lose my courage to go outside as part of everyday life.” “I hope my reconstructive surgery is as successful as others because their reconstructed breasts looked very nice and natural.”

**Question 2:**
Please conduct an information search using the Airiti Library for your case report, according to the above described scenario. If you encounter any difficulties while conducting the search, please write them down.

(1) What keywords and phrases were used for this search?

(2) Write down the best searching strategy that you have composed.

(3) How many articles have been yielded from this search using the searching strategy you proposed?

**Question 3: What do you think about this authentic online searching skills test?**
Rating scale for Online Searching Skills Test

Coding Number: ____________________

<table>
<thead>
<tr>
<th>Item description</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
</table>

**Question 1: Download the assigned article**

1.1 Academic database was used as an information resource

1.2 Database with full text was used

1.3 Fields were used (Ex: title, author, and journal was entered)

1.4 The required article was successfully downloaded

**Question 2: Conduct a search based on a given scenario**

2.1 Used suitable keywords or phrases

2.2 Advanced (combined) search was used

2.3 Synonyms were used

2.4 Boolean operators were used (two or more search terms were used)

2.5 Fields were correctly used, such as title, abstract, and journal

2.6 Limits were used, such as type of document, publication year, and areas

2.7 Number of search results was manageable (<50)

**Total Search Score** (1 score for use of each item)

Comments:
Part 4: Online Searching Self-efficacy Inventory (OSSI)

This scale is used to understand your confidence about online searching skills using electronic databases.

| Instruction: There is no right or wrong answer. Please rate each statement according to the degree to which you agree with it. The higher the score the more you agree with this statement. For example: 1=strongly disagree; 10=strongly agree. |
|---|---|---|---|---|---|---|---|---|---|---|
| 1. I can identify the most appropriate keywords or phrases for the information needed when I search a topic. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 2. I can identify alternate terminology, such as synonyms and broader or narrower terms, for the information needed. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 3. I can use a thesaurus in a database to select subject terms for searching. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4. I can construct a search using Boolean operators (e.g., AND, OR, NOT). | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 5. I can use a particular search field (e.g., title, URL, author) when searching for specific information. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 6. I can construct a keyword search so that my search words are found near each other, within the same paragraph of a document. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 7. I can construct a search to retrieve documents containing an exact phrase. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 8. I can construct a complex search using more than one Boolean operator and grouping terms together using parentheses. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 9. I can use truncation symbols (e.g., *, $) to find variants of search words (e.g., teach, teacher, teaching) when searching in a database. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 10. When subject terms relevant to a topic are shown in a database, I can search for additional information using those subject terms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11. I can determine when browsing in a database will be more effective than entering search terms. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 12. I can narrow or broaden my search to retrieve the appropriate quantity of information. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
**Part 5: Self-directed Learning Readiness Scale for Nursing Education**

This scale is used to evaluate the self-directed learning readiness of students through this online searching skills instruction workshop.

**Instruction:**
There is no right or wrong answer. Please rate ✓ each statement according to the degree to which you agree with it. The higher the score the more you agree with this statement. For example: 1=strongly disagree; 5=strongly agree.

<table>
<thead>
<tr>
<th></th>
<th>Strongly disagree</th>
<th>Disagree</th>
<th>Undecided</th>
<th>Agree</th>
<th>Strongly agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>I solve problems using a plan.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>I prioritise my work.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>I do not manage my time well.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>I have good management skills.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>I set strict time frames.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>I prefer to plan my own learning.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>I am systematic in my learning.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>I am able to focus on a problem.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9.</td>
<td>I need to know why.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>I critically evaluate new ideas.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>I prefer to set my own learning goals.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>I learn from my mistakes.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>I am open to new ideas.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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<tr>
<td>14.</td>
<td>When presented with a problem I cannot resolve, I will ask for assistance.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>I am responsible.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>I like to evaluate what I do.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>I have high personal expectations.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>I have high personal standards.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>19.</td>
<td>I have high beliefs in my abilities.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>I am aware of my own limitations.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>I am confident in my ability to search out information.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>I do not enjoy studying.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>23.</td>
<td>I have a need to learn.</td>
<td>1 2 3 4 5</td>
<td></td>
<td></td>
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<td></td>
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</tr>
<tr>
<td>24. I enjoy a challenge.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. I want to learn new information.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. I enjoy learning new information.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>27. I set specific times for my study.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>28. I am self-disciplined.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>29. I like to gather the facts before I make a decision.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>30. I am disorganized.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>31. I am logical.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>32. I am methodical.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>33. I evaluate my own performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>34. I prefer to set my own criteria on which to evaluate my performance.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>35. I am responsible for my own decisions/ actions.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>36. I can be trusted to pursue my own learning.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>37. I can find out information for myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>38. I like to make decisions for myself.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>39. I prefer to set my own goals.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>40. I am not in control of my life.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

**Instruction:**
There is no right or wrong answer. Please rate √ each statement according to the degree to which you agree with it. The higher the score the more you agree with this statement. For example: 1=strongly disagree; 5=strongly agree.
Research questionnaires: Chinese version

問卷填寫說明

同學您好:

這份問卷主要詢問有關你個人網路資料庫蒐集技巧的學習經驗與能力。問卷內容涵括個人基本資料以及四份問卷：線上資訊搜尋自我效能、自我導向學習準備度量表、線上資訊搜尋(資料庫)的知識測驗以及網路檢索技能測驗。

請根據您的看法，讀完每一小題以後，圈選一個最符合您的看法的，這些答案無所謂的對錯，那只是表示您的看法而已。請注意每一題都要回答，而且每一題只有一個答案！完成所有的問題大約費時三十分鐘，非常謝謝您填寫此問卷。

敬祝
學業進步，身體健康

澳洲 格理菲斯大學護理研究所
Judy Wollin
Ursula Kellett
蔡玲君 敬上
第一部分：研究個人基本資料

姓名: ___________ 學號: __________.

研究編號: ______________________

出生日期: 西元 ________年 ___月 ___日

性別:  □男       女

電子郵件地址: ______________________.

連絡電話: ______________________.

一、請根據題意，勾選適合您個人經驗的答案。

1. 我有網路輔助學習的經驗 □有  □否

2. 我有「如何使用中文電子期刊資料庫」的相關學習經驗 □有  □否

勾選有者，請註名上課時間

□約 30 分鐘  □約 1 小時  □約 2 小時  □約 4 小時  □多於 4 小時

3. 我有「如何使用英文電子期刊資料庫」的相關學習經驗 □有  □否

勾選有者，請註名上課時間

□約 30 分鐘  □約 1 小時  □約 2 小時  □約 4 小時  □多於 4 小時
二、底下的題目請依據你個人、上個學期的真實狀況回答所有問題。

填答說明：請評估您目前的感受是否與句中所描述一致。請由 5 至 1 給分，分數越大表示句中所描述的情形愈符合目前您的感受。

<table>
<thead>
<tr>
<th></th>
<th>幾乎沒有</th>
<th>偶爾有</th>
<th>普通</th>
<th>經常有</th>
<th>總是</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 當我需要進行網路學習時，總是有可用的電腦及網際網絡。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. 我使用學校的網路輔助平台資訊幫助學習。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. 我能夠自己完成網路輔助學習，例如：線上閱讀、下載資料和進行線上討論。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. 我的電腦能力能應付我的學習需要。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. 我的網路技巧能夠應付我的學習需要。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. 當我查詢資料時，我使用圖書館的館藏資訊系統。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. 我使用一般的網路搜尋引擎來搜尋學習需要的資訊，例如：Google, Yahoo 搜尋引擎。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. 我利用特定的專業或學術網站搜尋資料，例如: 衛生署網站、糖尿病衛教學會網站。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. 我使用學術性電子資料庫搜尋資訊，例如：思博網、中華民國期刊文獻資訊網或 CINAHL。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. 我被要求使用取自學術性電子資源的文獻完成報告(作業)。</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>
第二部分：線上資訊搜尋知識測驗

本單元評量您在線上資訊搜尋的認知程度(使用電子期刊資料庫的知識，例如：思博網、華藝線上圖書館或中華民國期刊文獻資訊網等)，共計16題。

請仔細閱讀所有題目，並在右側答案欄中圈選出你認為正確的答案。

<table>
<thead>
<tr>
<th>項目</th>
<th>說明</th>
<th>選項</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>當您要搜尋一篇全文的護理期刊文獻時，最好循以下哪一個途徑進行搜尋？ A.華藝線上圖書館(CEPS思博網+CETD電子學位論文服務整合查詢) B.中華民國期刊文獻資訊網 C.全國博碩士論文資訊網。</td>
<td>A B C</td>
</tr>
<tr>
<td>2.</td>
<td>當我想查詢台灣地區，最近十年的新生兒出生率，應循哪一資料庫搜尋第一手資料來源？ A.Yahoo奇摩搜尋 B.中華民國期刊文獻資訊網 C.行政院衛生署網站。</td>
<td>A B C</td>
</tr>
<tr>
<td>3.</td>
<td>下述何項資訊來源較不可靠、不適於專業報告內容？ A. [網址] (台灣護理學會) B. [網址] (中山大學機構典藏) C. [網址] (李相台診所)</td>
<td>A B C</td>
</tr>
<tr>
<td>4.</td>
<td>請問下述哪一組的關鍵字，可有效幫助您找到白血病患者接受化學治療後副作用的文獻？ A.(白血病 OR 化學治療) B.(白血病 AND 化學治療) C.(白血病 OR 症狀)。</td>
<td>A B C</td>
</tr>
<tr>
<td>5.</td>
<td>哪一個選項的下標線，沒有標出此標題的重要關鍵字？ A.協助一位結腸造廔病患適應身體心像改變的護理 B.糖尿病患者的自我照顧行為 C.高血壓患者的不遵從行為探討。</td>
<td>A B C</td>
</tr>
<tr>
<td>6.</td>
<td>若是您要完成一份「如何協助罹患腦瘤死亡兒童母親適應失落與哀傷」的相關讀書報告，下述哪一組檢索詞組較宜？ A.癌症與哀傷 B.母親與失落 C.死亡與兒童。</td>
<td>A B C</td>
</tr>
<tr>
<td>7.</td>
<td>若您需要完成一份「女性運動員使用類固醇傷害的相關讀書報告」，下述哪一組關鍵字的運用，最能幫助你找到適當的資訊。 A.婦女、藥物、副作用 B.女性運動員、健康傷害、類固醇 C.藥物、運動、表現。</td>
<td>A B C</td>
</tr>
<tr>
<td>8.</td>
<td>以下哪一個說明是資訊查詢時使用截斷符號的功用？ A.用來搜尋較多變化的檢索值字尾 B.讓兩個檢索值出現在文章的相近處 C.進行所有輸入檢索值的搜尋。</td>
<td>A B C</td>
</tr>
<tr>
<td>9.</td>
<td>在華藝線上圖書館中，哪一符號，可用來查詢英文關鍵字不限字母數目的截切功能，例如：「apply」、「applied」和「application」。 A.「！」 B.「*」 C.「$」。</td>
<td>A B C</td>
</tr>
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</tr>
<tr>
<td>11.</td>
<td>如何限制搜尋的文章是有關成年婦女使用母乳哺餵新生兒的相關文章？A.母乳哺餵 AND 嬰兒 B. (母乳哺餵 NOT 青少年) AND 嬰兒 C. (婦女 OR 母乳哺餵) AND 嬰兒。</td>
<td>A</td>
</tr>
<tr>
<td>12.</td>
<td>當您使用「健康照護」為查詢值後，出現了 232 筆相關文章，下述何者為最有效率的步驟，來減少資訊的數量？A.增加查詢的關鍵字 B.從篇題來找最有關聯的文章 C.改以「健康」為關鍵字再查詢一次。</td>
<td>A</td>
</tr>
<tr>
<td>13.</td>
<td>老師要求撰寫個案護理報告時，出自下列哪一資料庫的資訊，較不適合引用於你的作業？A. Yahoo 奇摩搜尋 B. 中華民國期刊論文資訊網 C. 華藝線上圖書館。</td>
<td>A</td>
</tr>
<tr>
<td>14.</td>
<td>當您從華藝線上圖書館，無法找到足夠的資訊來完成個案報告時，下述何者較適合您採用並進行另一次的資料檢索？A. Yahoo 奇摩搜尋 B. 中華民國期刊論文資訊網 C. 全國文獻傳遞服務系統(NDDS)。</td>
<td>A</td>
</tr>
<tr>
<td>15.</td>
<td>當您搜尋「張蓓貞(2000)-職業衛生與護理-於黃璉華總校閱-公共衛生護理概論(七版，535-544 頁)」，請問這份資料是下述哪一種參考資料？A. 書 B. 書的一個章節 C. 期刊雜誌。</td>
<td>A</td>
</tr>
</tbody>
</table>
第三部分：網路檢索技能測驗

技能的評分標準乃根據您所描述的網路資訊檢索技能項目來計分，使用愈多項的技巧得分愈高。網路檢索技巧包括：使用一個以上的搜索詞、使用布林邏輯運算元、使用特定欄位查詢功能以及文獻查詢的數量是合理的。

1. 請您利用網路下載本篇文獻 「張瑛瑛、王曼溪(2008)─探討護理人員主觀之護理能力及其相關因素:榮總護理・25(4)・334-341。」

(1)請寫下您將如何使用網路搜尋的技巧找到本文獻? (字數不限，請盡量作答!)

(2)請將此篇文章下載並儲存在的電腦桌面上。(註*若您不知如何操作，請回答不會，並跳至第 2 題繼續作答。)

情境：
李女士，45 歲，是一位從事造型設計師的單親媽媽，在住院前三個月意外發現右側乳房腫塊，經檢查後確立診斷為乳癌，因此入院接受右側改良性全乳根除術。

護士發現個案原本旅居國外，是一位相當時髦前衛的服飾設計者也是個獨立性強的單親媽媽，但是這突如其來的疾病令她措手不及，且情緒低落。在手術前，護士經過李女士病房門口時，會發現她望著窗外發呆或是低聲嘆氣。她對護士說：「本來只是檢查，沒想到出這麼大的問題，短短幾天變化真大，唉!」。手術後在為進行傷口敷料更換的時候，護士發現李女士不敢直視傷口，多次詢問醫生或護士「右邊的乳房還好嗎?」、「摸起來還軟軟的嗎?」、「跟左邊感覺好像不一樣，這是正常的嗎?」。出院前，患者向護士提起「兩側胸口高低差很多，將來穿衣服會不會很奇怪?」、「出院後不知道我敢不敢出門?」、「看到別人
的乳房重建外觀都好漂亮，看不出來是做的，不知道我的會不會跟他們的一樣！」。

2. 請利用，來執行上述個案的讀書報告資料搜集。若您在使用本資料庫進行資料搜尋有任何困難，請註明原因。

(1) 根據以上的案例描述，您會使用哪些關鍵字或片語來搜尋需要的文獻? (數目不限，請盡量作答)

(2) 請您利用電腦進行指定的資料庫中執行資訊檢索，並將您認為最適合的搜尋策略或網路搜尋路徑寫下來。(次頁附有文章查詢模式與進階查詢模式樣本)

(3) 請問依此搜尋策略，實際操作會產生多少篇文獻?

3. 您對這次網路檢索技能測驗有何想法?
第四部分：線上資訊搜尋自我效能

這個單元的問卷，是用來要瞭解你對使用電子期刊資料庫(例如：思博網、華藝線上圖書館或中華民國期刊文獻資訊網等)來搜尋資訊的自我效能。

填答說明：請評估您目前的感受是否與句中所描述一致。請由 1 到 10 給分，分數愈高表示句中所描述的情形愈符合你的情形。

<table>
<thead>
<tr>
<th>完全不同意(1)</th>
<th>十分同意 (10)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 當我搜尋一個主題時，我能想到最適合我所需要資訊的關鍵字或詞組。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>2. 對所需要的資訊，我能想到替代的術語，如同義詞和廣義詞或狹義詞。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>3. 我能用資料庫中的同義詞典，來選擇搜尋用的主題詞。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>4. 我能執行一個使用布林邏輯運算元(例如，AND, OR, NOT)的搜尋。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>5. 當搜尋特定的資訊時，我能使用一個特定的搜尋欄位(例如，書名/篇名、網址與作者)。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>6. 我能執行一種關鍵字搜尋，讓搜索用詞是出現在文章的同一段落，並且彼此接近。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>7. 我能執行一種搜尋，找出包含一個完全一樣詞組的文章。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>8. 我能執行一種複雜的搜尋，使用一個以上的布林運算元並用括號將查詢值組合起來。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>9. 當針對一資料庫進行搜尋時，我能使用截斷符號(例如，*、$)來找出變種的搜索詞，例如：教、教師、教學。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>10. 當有關一個主題的主題詞顯示在資料庫中時，我能利用這些主題詞搜尋出額外的資訊。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>11. 我能決定何時瀏覽一個資料庫會比鍵入搜索字詞更有效率。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
<tr>
<td>12. 我能擴大或縮小我的搜尋去獲取適量的資訊。</td>
<td>1 2 3 4 5 6 7 8 9 10</td>
</tr>
</tbody>
</table>
第五部分：自我導向學習準備度量表

以下的問題是用來評量您在自我導向學習之個人特質、技能和動機因素的感受程度。請根據您自己感覺的程度，回答每一道題目。

填答說明：請評估您目前的感受是否與句中所描述一致。請在右側答案欄中，圈選合適的選項。選項給分由 1 至 5，分數愈高代表題目中描述的情形愈符合目前您的感受。

<table>
<thead>
<tr>
<th>項目</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 我擬定計畫來解決問題</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2. 我會安排工作的優先順序</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3. 我不善於時間管理</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4. 我有好的管理技巧</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5. 我擬定嚴謹的時間表</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>6. 我比較喜歡計劃自己的學習</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7. 我的學習是有系統的</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8. 我能專心地處理一個問題</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9. 我需要知道為什麼</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10. 我會以批判的角度衡量新的想法</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. 我較喜歡設定自己的學習目標</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. 我從錯誤中學習</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13. 我願意接受新的想法</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>14. 當面對一個無法解決的問題時，我會尋求幫助</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>15. 我有責任感</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. 我喜歡評量自己所做的</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. 我有高的自我期許</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. 我有高的自我標準</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>19. 我很相信自己的能力</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. 我知道自己的限制</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>21. 我對自己找出資訊的能力有信心</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>22. 我不喜歡讀書</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>23. 我有學習的需要</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>24. 我喜歡挑戰</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>25. 我想要學習新的資訊</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>26. 我喜歡學習新的資訊</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>27. 我安排特定的時間讀書</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>28. 我是自律的</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>29. 做決定前我會先去搜集資料</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>30. 我做事沒有組織性</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>31. 我很有邏輯的</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>32. 我做事很有條理</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>33. 我評量我自己的表現</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>34. 我較喜歡設定自己的標準來衡量自己的表現</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>35. 我能為自己的決定(或行為)負責</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>36. 我能被信任去進行自我的學習</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>37. 我能找到自己需要的資訊</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>38. 我喜歡自己做決定</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>39. 我較喜歡設定自己的目標</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>40. 我不能掌控自己的生活</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

填答說明：請評估您目前的感受是否與句中所描述一致。請在右側答案欄中，圈選合適的選項，選項給分由 1 至 5，分數愈高代表題目中描述的情形愈符合目前您的感受。
Appendix 5: Questionnaire translation

The translation of the online searching self-efficacy inventory (OSSI) [by Monoi, O'Hanlon, and Diaz (2005)] and the self-directed learning readiness for nursing education (SDLRSNE) scale [by Fisher, King, and Tague (2001)] was informed by the following described procedure.

Step one: forward- and back-translation process:

1. The source version of the questionnaire was translated to the target language by two bilingual nursing educators and one accredited translator working on all items together to translate the instrument from English to Chinese (Flaherty et al., 1988). The bilingual nursing educators were invited because they understood the concept of the instruments and the target population, which was critical in maximising the equivalence of translation and assuring the appropriateness of language use (Yu et al., 2004).

2. The translated Chinese scale then was back-translated into English by an accredited translator. The translator was ‘blinded’ to the original English version. The blind method should ensure that the meaning of the translated Chinese version of tools is adequately reflected in the back-translated instrument (Yu et al., 2004).

3. A comparison was made by the researcher between the wording of original items and their back-translated counterparts to detect any possible alterations resulting from the translation (Polit & Beck, 2012).

Step two: the verifying of semantic equivalence:

One monolingual rater examined the original and back-translated forms of items and wrote down errors that they felt would lead to differences in meaning if the two forms were administered (Brislin, 1970).

Step three: the verifying of content equivalence (expert content validity):

A panel of educators (n =3) with experience in teaching Associate Degree in Nursing students in using online searching rated the content equivalence of each item. A 4-point Likert-type scale in an ascending trend of “relevancy” was used; for which 4 refers to “exactly relevant”, 3 equals “relevant”, 2
equals “questionably relevant”, and 1 equals “irrelevant” (Flaherty et al., 1988). A content validity index (CVI) was calculated based on the percentage of items that was rated as relevant by the panel members (Polit & Beck, 2012). If the average score for each item was less than 3, it was modified (Yu et al., 2004). A comparison table of the translated, back-translated and Chinese version questionnaires of the SDLRSNE and OSSI appears on the following page.

**Name list of panel for questionnaire translation**

**English to Chinese:**
- Miss Yeh Ly-Chun 葉麗娟,
- Mrs. Tsai Ling-Chun 蔡玲君,
- Mr. Yang Daniel 楊其安

**Chinese to English:** Mrs. Shirley Yu (accredited translator)

**Experts for content equivalence:**
- Associate Professor Ho Mei-Yo 何美瑤,
- Assistant Professor Lin Pi-Li 林碧莉,
- Associate Professor Lin Ming-Chen 林明珍
A comparison of translated and back-translated Online Searching Skills Self-efficacy (OSSI) scale

<table>
<thead>
<tr>
<th>Original version</th>
<th>Back-translated version</th>
<th>Chinese translated version</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I can identify the most appropriate keywords or phrases for the information</td>
<td>1. When searching on a subject, I can find the most suitable keywords or phrases which</td>
<td>1. 當我搜尋一個主題時，我能想到最適合我所需資料的關鍵字或詞組。</td>
</tr>
<tr>
<td>needed when I search a topic.</td>
<td>lead me to the information I need.</td>
<td></td>
</tr>
<tr>
<td>2. I can identify alternate terminology, such as synonyms and broader or</td>
<td>2. I can think of the alternative terminology, such as synonyms, broader terms and</td>
<td>2. 對所需要的資料，我能想到替代的術語，如同義詞和廣義詞。</td>
</tr>
<tr>
<td>narrower terms, for the information needed.</td>
<td>narrower terms, for the information needed.</td>
<td></td>
</tr>
<tr>
<td>3. I can use a thesaurus in a database to select subject terms for searching.</td>
<td>3. I can use the synonym dictionary from the database to choose the subject words for</td>
<td>3. 我能用資料庫中的同義詞典來選擇搜尋用的主題詞。</td>
</tr>
<tr>
<td></td>
<td>searching.</td>
<td></td>
</tr>
<tr>
<td>4. I can construct a search using Boolean operators (e.g., AND, OR, NOT).</td>
<td>4. I can execute a search using Boolean logic operators (for example, AND, OR, NOT).</td>
<td>4. 我能執行一個使用布林邏輯運算元（例如，AND, OR, NOT）的搜尋。</td>
</tr>
<tr>
<td></td>
<td>5. When searching for specific information, I can use a special searching column (for</td>
<td>5. 當搜尋特定的資訊時，我能使用一個特定的搜尋欄位（例如，書名/篇名/網址與作者）。</td>
</tr>
<tr>
<td></td>
<td>example, book name/article name, website and author).</td>
<td></td>
</tr>
<tr>
<td>6. I can construct a keyword search so that my search words are found near each</td>
<td>6. I can execute a type of key words search so that the key words can appear on the</td>
<td>6. 我能執行一種關鍵字搜尋，讓搜索用詞在文章的同一段落，並且彼此接近。</td>
</tr>
<tr>
<td>other, within the same paragraph of a document.</td>
<td>same paragraph of an article and be close to each other.</td>
<td></td>
</tr>
<tr>
<td>7. I can construct a search to retrieve documents containing an exact phrase.</td>
<td>7. I can execute one kind of search to find articles that include one identified phrase.</td>
<td>7. 我能執行一種搜尋，找出包含一個完全一樣詞組的文章。</td>
</tr>
<tr>
<td></td>
<td>8. I can execute a complicated search to use one or more Boolean logic operators and</td>
<td>8. 我能執行一種複雜的搜尋，使用一個以上的布林運算元並用括號將查詢值組合起來。</td>
</tr>
<tr>
<td></td>
<td>combine the search factors with brackets.</td>
<td></td>
</tr>
<tr>
<td>9. I can use truncation symbols (e.g., *, $) to find variants of search words</td>
<td>9. When searching a specific database, I can use truncation symbols (such as *, $) to</td>
<td>9. 當針對資料庫進行搜尋時，我能使用截斷符號（例如，*, $）來找出變種的搜尋詞，例如，教、教師、教學。</td>
</tr>
<tr>
<td>(e.g., teach, teacher, teaching) when searching in a database.</td>
<td>find out derivative words (for example, teach, teacher, teaching).</td>
<td></td>
</tr>
<tr>
<td>10. When subject terms relevant to a topic are shown in a database, I can search</td>
<td>10. When the subject words of a subject appear in the database, I can find extra</td>
<td>10. 當有關同一主題的主題詞顯示在資料庫中時，我能利用這些主題詞搜尋出額外的資料。</td>
</tr>
<tr>
<td>for additional information using those subject terms.</td>
<td>information using those subject words.</td>
<td></td>
</tr>
<tr>
<td>11. I can determine when browsing in a database will</td>
<td>11. I can decide when it is more efficient to browse the</td>
<td>11. 我能決定何時瀏覽一個資料庫。</td>
</tr>
<tr>
<td>12. I can narrow or broaden my search to retrieve the appropriate quantity of information.</td>
<td>12. I can enlarge or narrow my search to get the appropriate information.</td>
<td>12. 我能擴大或縮小我的搜尋去擷取適量的資訊。</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>be more effective than entering search terms.</td>
<td>database than to type a searching word.</td>
<td>料庫會比鍵入搜索字詞更有效率。</td>
</tr>
<tr>
<td>Original version</td>
<td>Back-translated version</td>
<td>Chinese translated version</td>
</tr>
<tr>
<td>------------------</td>
<td>-------------------------</td>
<td>----------------------------</td>
</tr>
<tr>
<td>1. I solve problems using a plan.</td>
<td>1. I make a plan to work out problems.</td>
<td>1. 我擬定計畫來解決問題</td>
</tr>
<tr>
<td>2. I prioritize my work.</td>
<td>2. I can sort out priorities of job procedures.</td>
<td>2. 我會安排工作的優先順序</td>
</tr>
<tr>
<td>3. I do not manage my time well.</td>
<td>3. I am not capable of time management.</td>
<td>3. 我不善於時間管理</td>
</tr>
<tr>
<td>4. I have good management skills.</td>
<td>4. I have good management skills.</td>
<td>4. 我有好的管理技巧</td>
</tr>
<tr>
<td>5. I set strict time frames.</td>
<td>5. I make a strict timetable.</td>
<td>5. 我擬定嚴謹的時間表</td>
</tr>
<tr>
<td>6. I prefer to plan my own learning.</td>
<td>6. I prefer to make plans for my study.</td>
<td>6. 我比較喜歡計劃自己的學習</td>
</tr>
<tr>
<td>7. I am systematic in my learning.</td>
<td>7. My study is systematic.</td>
<td>7. 我的學習是有系統的</td>
</tr>
<tr>
<td>8. I am able to focus on a problem.</td>
<td>8. I can concentrate on one single issue.</td>
<td>8. 我能專心地處理一個問題</td>
</tr>
<tr>
<td>9. I need to know why.</td>
<td>9. I need to know why.</td>
<td>9. 我需要知道為什麼</td>
</tr>
<tr>
<td>10. I critically evaluate new ideas.</td>
<td>10. I can judge new thoughts from a critical perspective point of view.</td>
<td>10. 我會以批判的角度衡量新的想法</td>
</tr>
<tr>
<td>11. I prefer to set my own learning goals.</td>
<td>11. I prefer to set goals for my study.</td>
<td>11. 我較喜歡設定自己的學習目標</td>
</tr>
<tr>
<td>12. I learn from my mistakes.</td>
<td>12. I can learn from mistakes.</td>
<td>12. 我從錯誤中學習</td>
</tr>
<tr>
<td>13. I am open to new ideas.</td>
<td>13. I am willing to accept new thoughts.</td>
<td>13. 我願意接納新的想法</td>
</tr>
<tr>
<td>15. I am responsible.</td>
<td>15. I have responsibility.</td>
<td>15. 我有責任感</td>
</tr>
<tr>
<td>16. I like to evaluate what I do.</td>
<td>16. I like to assess what I have done.</td>
<td>16. 我喜歡評估自己所做的</td>
</tr>
<tr>
<td>17. I have high personal expectations.</td>
<td>17. I have high self-expectations.</td>
<td>17. 我有高的自我期許</td>
</tr>
<tr>
<td>18. I have high personal standards.</td>
<td>18. I have high self-standards.</td>
<td>18. 我有高的自我標準</td>
</tr>
<tr>
<td>19. I have high beliefs in my abilities.</td>
<td>19. I believe in my ability very much.</td>
<td>19. 我很相信自己的能力</td>
</tr>
<tr>
<td>20. I am aware of my own limitations.</td>
<td>20. I know my limitations.</td>
<td>20. 我知道自己的限制</td>
</tr>
<tr>
<td>21. I am confident in my ability to search out information.</td>
<td>21. I have confidence in my ability to find out information.</td>
<td>21. 我對自己找資料的能力有信心</td>
</tr>
<tr>
<td>22. I do not enjoy studying.</td>
<td>22. I don’t like studying.</td>
<td>22. 我不喜歡讀書</td>
</tr>
<tr>
<td>23. I have a need to learn.</td>
<td>23. I have a need to study.</td>
<td>23. 我有學習的需要</td>
</tr>
<tr>
<td>25.</td>
<td>I want to learn new information.</td>
<td>25.</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------------------</td>
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</tr>
<tr>
<td>27.</td>
<td>I set specific times for my study.</td>
<td>27.</td>
</tr>
<tr>
<td>28.</td>
<td>I am self-disciplined.</td>
<td>28.</td>
</tr>
<tr>
<td>29.</td>
<td>I like to gather the facts before I make a decision.</td>
<td>29.</td>
</tr>
<tr>
<td>30.</td>
<td>I am disorganized.</td>
<td>30.</td>
</tr>
<tr>
<td>31.</td>
<td>I am logical.</td>
<td>31.</td>
</tr>
<tr>
<td>32.</td>
<td>I am methodical.</td>
<td>32.</td>
</tr>
<tr>
<td>33.</td>
<td>I evaluate my own performance.</td>
<td>33.</td>
</tr>
<tr>
<td>34.</td>
<td>I prefer to set my own criteria on which to evaluate my performance.</td>
<td>34.</td>
</tr>
<tr>
<td>35.</td>
<td>I am responsible for my own decisions/actions.</td>
<td>35.</td>
</tr>
<tr>
<td>36.</td>
<td>I can be trusted to pursue my own learning.</td>
<td>36.</td>
</tr>
<tr>
<td>37.</td>
<td>I can find out information for myself.</td>
<td>37.</td>
</tr>
<tr>
<td>38.</td>
<td>I like to make decisions for myself.</td>
<td>38.</td>
</tr>
<tr>
<td>39.</td>
<td>I prefer to set my own goals.</td>
<td>39.</td>
</tr>
<tr>
<td>40.</td>
<td>I am not in control of my life.</td>
<td>40.</td>
</tr>
</tbody>
</table>
Appendix 6: Example from the online self-paced learning module

English version

Learning objective

• This module will assist you to

1. Understand the significance of information searching skills
2. Learn more effective searching skills

Contents

• This module includes:

1. How fonnallion seallng skills innuc̄c̄ personalprofessional development

Introduction

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tnstrart, md efrcenily wth th. acqured mforUIIOID
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The importance of information literacy

The Australian and New Zealand Institute for Information Literacy (ANZIL) emphasizes information literacy as the foundation of self-directed learning (SOL) and lifelong learning (LL) of individuals (Bundy, 2004).

The significance of SOL and LL

- There are significant changes in Taiwan due to rapid development in technology. Information literacy (IL) is fundamental.
- IL and lifelong learning (LL) can improve learning outcomes. Effective information seeking abilities are essential in the information age.
- Nursing schools in Taiwan require students to have a high level of self-directed learning to support knowledge and practice competencies.

LL - one core value in nursing profession

- Lifelong learning (LL) has been approved by the Nursing Accreditation Council (TNAC) in Taiwan as one of the required professional core accomplishments for nursing students (Yu, 2005).
- Nursing graduates are expected to be equipped with this ability so as to provide safe and quality care.

Information literacy and library database searching skills

- Information literacy is an abstract concept. However, an information literate nurse will be competent in using a computer and the Internet to retrieve information from library databases (Saw & Hvoslev, 2004).

Information literacy and nursing professional development

- Many nursing scholars asserted the significance of assistive students to establish effective information seeking skills because these very skills are the key for professional development of individuals (Hsu, 2002; Bannard, Nash, & O’Brien, 2005).

Nursing Clinical Ladder System

- According to the Nursing Clinical Ladder System in Taiwan, nurses are expected to develop clinical care delivery but also in the area of health-related skills. These skills include information literacy and academic writing skills (Lin, Chang, & Hsu, 2004).
- Research skills qualification for promotion:
  - From N0 to N1: Acquire, demonstrate and approved.
  - From N1 to N2: Case study, maximum 20-30 pages.
  - From N2 to N3: Case study, maximum 30 and above pages.

TaiWu Nurse: Assessor (2009)
2. How information searching skills influence quality promotion in clinical nursing care

Definition
• The **evidence-based nursing** is that clinical nurses can make the best decision based on the integration of current research evidence, policy of the organization, judgment of experts and preference of patients (Peirce & Basse-Niowski, 2006).

Evidence-based practice in nursing care
• Gradually, evidence-based thinking has become popular in clinical practice. Research shows that the implementation of evidence-based nursing care induced a significantly better outcome in the areas of patient behaviour, knowledge, and mental and physical aspects than did traditional nursing care (Heuter, Bresler, & Olson, 1988).

Four elements

Access to multiple sources of evidence
• Access to multiple sources of evidence refers to the ability of nurses to access computers, the Internet and databases. In addition, they should have adequate information searching skills and sufficient time to critically evaluate retrieved information (Jan & Liu, 2009).

Knowledge in research evidence
This element highlights that nurses need to be equipped with the ability to locate the latest and quality resources, be able to critically appraise the information (Jan & Liu, 2009).

Quality refers: references from the Journal of Nursing, Nursing Times, National Digital Library of Medical and Scientific Information, Clinical Evidence, etc. to Nursing and Allied Healthcare Online (NURSAL), and MEDLINE.

Thus, the e is: a need for a simple, practical, and effective form of evidence based practice.
Evidenced-based nursing and information searching skills

• The presence of evidence-based nursing has been approved to promote patient safety and quality of clinical care. However, the requirement for nurses to carry out evidence-based practice is one of their abilities to read and critically evaluate information needed (Fan & Liu, 2009).

• In information explosion age, having effective information searching ability is a basic competency for nurses (Shorten, Wallace, & Crooke, 2001).

3. Information searching skills of individuals refer to personal problem-solving abilities

Information seeking and information needs

People will perceive the need for information for problem-solving when they find themselves in an unfamiliar situation for certain things.

Thus, information seeking is defined as an action for an individual to satisfy one’s information need (Yi & Wang, 2001).

Type of information needed

• Information needed for nurses can be categorized as follows (Lin, Clung, & Hu, 2004):

  - Professional need

  - Personal need

  - Necessity of the patient

  - Additional need

Information literacy and problem-solving ability

• Information literacy, defined by McClure (1994), is one kind of problem-solving ability in information.

• This indicates that individuals with better information processing are more likely to show better problem-solving abilities.

Aims of information seeking

• Empirical evidence supports the notion that information searching refers to health professional's problem-solving ability.

  • The study by Yell (2000) showed that the nurses of the hospital were better at searching for information than those in smaller hospitals.

  • O2 study, M. V. 32 medical 55nWus 3Yd 260Zd 361nIF the evidence of the problems and findings of the nurses were the results.

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Summary

- Online information seeking is one of the essential competencies for mobile profession. Use the tag to:
  - be able to find self-deployment, lifecycle, 
  - promote...in clinical care.
- show problem-solving abilities.
- Encouragement

- Is your motivated to learn further information seeking skills after the module?
- Please login to the e-platform and tell us your experiences about information searching.
- You are now ready to advance to the next module.
單元目標

在您完成本單元的自我學習後，能夠
1. 71¥ aRJtt UJY:1m11
2. iJg i1j ™& ¥J ffl & 15

單元介紹

1. ffil. (Information literacy)

2. 參考文獻
資訊素養的重要性


自我導向與終生學習的重要性


終身學習—護理專業核心素養


網路搜尋技巧是資訊素養的表現


資訊素養與護理專業發展


臨床護理人員進階制度


台灣護理學會(2009)
2. 資訊搜尋技巧影響護理照護品質的提升

臨床照護趨勢-實證護理
- (Evidence-based nursing)

 execution

 iHiOi a \ 海

 實證要素-對研究證據的知識
- "Cumulative Index to Nursing and Allied Health Literature (CINAHL)"
- MEDLINE

 實證要素-可得到適當的資源
- "Cumulative Index to Nursing and Allied Health Literature (CINAHL)"
- MEDLINE
實證護理與資訊搜尋技巧

3. mt+t / 5

護理人員之資訊需要類別

- 成長性需求來源於許多自我成長的期待而產生的資訊需求行為，如尋找資訊來展開個案的報告(專業、個案報告、護理報告或系統分析)。
- 資訊需求則包括為解決病患的護理需要，而產生的資訊需求行為，

資訊素養與問題解決能力

- 因此有較佳資訊素養與資訊搜尋技巧的學員，較能有效的使用所使用的資訊來解決問題。

另一項針對32位專科護師的訪談也指出，護師們的資訊需要行為，與其了解病患相關診療治療的問題(王，2002)。“

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經驗分享時間
Time for sharing

侯玟琦老師分享

學姊的分享

叮嚀的話
- 請點擊單元二的網路學習活動
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