

行政院國家科學委員會專題研究計畫 成果報告

影響遠距照護系統接受意向因素之研究-居家式與機構式使用者之觀點 研究成果報告(精簡版)

計畫類別：個別型
計畫編號：NSC 97-2410-H-041-007-
執行期間：97年08月01日至98年08月31日
執行單位：嘉南藥理科技大學資訊管理系

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報告附件：出席國際會議研究心得報告及發表論文

處理方式：本計畫涉及專利或其他智慧財產權，2年後可公開查詢

中 華 民 國 98 年 10 月 27 日

行政院國家科學委員會補助專題研究計畫 ☒ 成果報告
☐ 期中進度報告

影響遠距照護系統接受意向因素之研究-居家式與機構式使用者之觀點

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計畫編號：NSC 97-2410-H-041 -007-

執行期間：97 年 8 月 1 日至 98 年 7 月 31 日

計畫主持人：劉忠峰

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成果報告類型(依經費核定清單規定繳交)：☒ 精簡報告 ☐ 完整報告

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執行單位：嘉南藥理科技大學

中 華 民 國 98 年 10 月

摘要

我國已邁入高齡化社會，對於各種長期照護之需求將更殷切，而使用遠距照護來協助照護工作之進行，將是重要的發展方向。本研究參考相關研究，以高階主管之觀點，提出一個包含「環境」、「組織」、「遠距照護特性」與「專案管理」四構面共 12 變數的架構，用以探討影響機構導入遠距照護之關鍵因素。本研究採用問卷調查法進行資料蒐集，針對全國 339 家護理照護機構進行普查，共計回收有效問卷 63 份，回收率為 18.58%。經由 Partial Least Squares PLS) 分析發現，「醫療政策」、「管理活動需求」、「機構任務型態」與「遠距照護之相對優勢」等四個因素對高階主管導入遠距照護之意願具有顯著的影響。本研究期望能作為政府、照護機構發展與導入遠距照護之參考，並強化學術界對於遠距照護領域之相關管理性研究。

關鍵字：政府政策、遠距照護、照護機構

1. 前言

依據行政院經建會所作的人口推估得知，2005 年我國 65 歲以上人口比率已超過 9%，到了 2020 年將高達 14%，人口老化速度將僅次於日本，而高居全球第二。高齡化意味著國家生產人力將逐漸減少，受撫養的人口將會增加，而在整體照護服務上，除了需求量的提升之外，其服務性質也會隨之改變，例如：送餐、派車、關懷問候之服務等(Selwyn, Gorard, Furlong & Madden, 2003)。高齡族群的特性之一即為慢性病之罹患率上升，身體功能退化，而且會有相當多的比例是以失能(Disabled)的型態生活著，而這些人口就需要有效的長期照護(Long-term Care)服務網絡來支援，並希望達到在地老化(Aging in Place)之目標，而此項公共服務建設能否妥善發展，政府將扮演重要的角色。

然而，家庭環境的變遷與政治經濟的局勢，已讓政府難以獨力支撐日益多元化與專業化之長期照顧服務之需求。因此，政府有必要結合民間的力量，發展相關的科技與服務模式，共同提供照顧服務的新契機，並在不影響服務品質的前提下，思考提升效率與降低成本的方法。因此，遠距照護(Telecare)服務的概念因應而生。遠距照護服務無論在社會經濟發展層面與醫療照護層面，皆有成為新興產業的潛在實力。由商業角度來看，老年人口數在可預見的未來將大幅增長，加上政府老年年金制度的推動，老年經濟自主性亦相對提高，顯見老年照顧服務市場深具潛力。由就業市場來看，照顧服務產業是勞力密集的內需產業，因相關非專業醫護人才之照護工作訓練較易，所以可創造現階段中高齡失業者投入此產業爭工作機會。就醫療照護層次來看，遠距照護除了實際醫師的遠距會診等醫療行為之外，遠距照護可以定位為一種服務與消費性質之行為，如此一來將可與嚴格且繁複的醫療相關規範做出區隔，提高遠距照護成為可長可久之新興產業之可行性。

對於照護機構來說，遠距照護服務被視為有效節省照護成本與提升照護績效之方式，然相關資通訊設備之經費投資、政經環境之考量以及機構內部人員是否能接受，均是高階主管考慮是否導入遠距照護之重點，因此，探討影響機構高階主管導入遠距照護之因素將是產官學界相當關心之議題。

2. 文獻探討

2.1 機構式長期照護服務模式

機構式照護提供老人全天候的住院服務，服務內容包含醫療、護理、復健、個人與生活照護等(吳淑瓊、江東亮，1995)。除了對老人的全天候照護外，也提供一些重症及慢性病患的照護服務，機構式的是以專業的照護人員提供完善的設備和專業的技術讓受照顧者受到 24 小時的全時照顧。機構式又可細分為「護理之家」、「長期照護機構」、「居住照護」、「安養機構(老人安養院)」、「榮民之家」與「安寧照護機構」等六類(陳晶瑩，2003)。

2.2 遠距照護服務模式

2.2.1 遠距醫療與遠距照護之定義

如同電子商務這類新興議題一樣，許多學者亦從不同角度來對「遠距醫療(Telemedicine)」、「遠距照護(Telecare)」做過定義。廣義的遠距醫療，是指透過資通訊技術能夠提供遠程的照護服務(Barnes et al., 2006)；陸哲駒等人(2004)定義遠距醫療為泛指應用媒體科技系統，突破時空控制，以從事互動式醫療專業諮詢與顧問服務；亦即遠距醫療技術可以應用在醫院管理、遠距醫學教育、遠距放射科(Teleradiology)、遠距病理科(Telepathology)、遠距居家照護(Telehomecare, THC)、遠距急救學(Tele-emergency)...等等(陸哲駒等人，2004)。此觀點主張遠距照護相關的服務，乃屬廣義遠距醫療的範疇。

另一方面，Barlow et al.(2005)定義遠距照護為：「使用資通訊科技(Information and Communication Technology, ICT)來直接地幫助傳遞健康與社會關懷(Deliver Health and

Social Care)給在自家中的人們」，亦即遠距照護在照護領域當中的一個重要創新，就是透過資通訊科技來遠端地支援與提供照護服務於人們(服務使用者；Service Users)自己的家中(Barnes et al., 2006)。此所謂的資通訊科技，可包含：軟硬體、通訊網路(含網路頻寬)、應用系統、多媒體系統、視訊系統、監控系統以及數位化之生理量測儀器等等。

廣義而言，遠距照護是由遠距醫療所衍生出的醫療技術，但本研究以衛生署的觀點，較為狹義的區分兩者，主要差別在於遠距醫療可以透過資訊技術和通訊科技來進行醫療行為(醫師為主)與知識教育，而遠距照護是透過儀器和程式來進行預防和管理病患的生活(照護人員為主)。

2.2.2 遠距照護服務的功能

根據 Miller(1995)的書中所述，老年時間的需求劃分可分為三大層面，遠距照護在這些層面都有其發揮空間。

- (1) 居家安全層面：這層面所考慮的是受照顧者由於年齡所造成的生理老化方面，可能會導致的生活上的不便或風險。此層面的問題時常可以從報章雜誌上發現，老人出現的各種意外事件也大多是源自此因素。在瞭解受照顧者在居家時生活與安全上的問題，可分為生理退化(體力、注意力、視力、記憶力等)及環境安全(火災、竊盜、氣候等)兩大問題。要解決此層面的問題可在屋內裝設監控系統來瞭解受照顧者的動向及情況，以確保受照顧者的安全，不過也需注意到受照顧者的隱私及感受等問題。
- (2) 生理健康層面：由於年齡的因素，所以受照顧者可能身受許多種不同的疾病侵擾。根據病症的性質大致上可分為突發性與慢性兩種。突發性疾病中較常見的為中風、突發性心臟病等。這類的疾病大部份已經可以透過長期的生理訊號變化分析中觀察出來。而慢性的部份有糖尿病、高血壓等。這類的疾病目前也可透過藥物接受治療。目前有許多機構在針對此層面進行研究，希望能夠透過“無時無刻”的生理訊息測量來瞭解受照顧者的健康情況，並做到控制及預防的工作。
- (3) 心理健康層面：常言道：心理影響生理。人的精神力量常常能夠影響一個人的健康情況。因此在居家照護的技術上，必須要能夠照護到受照顧者的心理健康層面，如透過視訊互動的技術來達到家人互相陪伴照顧的目的等。

遠距照護即是透過特定用途或穿戴式之生理訊號感測器，並將感測器即時所偵測之特定生理資訊(如，血壓、血糖、心跳等)進行記錄與通告專業醫療協助者加以分析及處理。此外，也會透過單一種類且平價型的感測器(如視訊之監視器、壓力感測器、紅外線感測器或聲音感測器等)，並藉由分析此類感測器所偵測之環境資訊，進而推論出被照護者目前的生活行為狀態，當在認定被照護者行為狀態可能發生異常時，發出是否發生意外事件種類之訊問，並在確認完結果之後向特定之協助者(如醫師、看護或家人)發送救援信息(吳嘉珉，民 95)。

2.3 影響創新科技導入之因素

由於資訊科技/資訊系統導入對於組織產生相當大的衝擊，而且往往需要耗費龐大的人力、物力、成本以及相關資源的投入，並可能改變現有相關作業之流程，已有相當多的學者針對影響組織導入資訊科技/資訊系統的因素進行研究。Rogers(1983)認為組織領導人的特性、組織內部結構以及組織的外部特性會影響組織創新科技的採用。Tornatzky and Fleischer (1990) 基於 Rogers(1983) 的論點，發展出科技－組織－環境(Technology-Organization-Environment, TOE)架構來探討影響資訊科技的導入決策。相關研究也發現：個人、組織、環境因素皆為影響創新採用的關鍵因素(Cooper and Zmud, 1990; Chang et al., 2006; Chau and Tam, 1997; Choe, 1996; Grover, 1993; 黃興進等人，2001)，所探討之相關因素也於醫療資訊應用領域(Brook and Magure, 1998; Sobol et al.,1999)以及護理資

訊領域(Hilz, 2000; Lee, 2004; Zielstorff, et al., 1993; Goossen et al., 1996)獲得驗證，顯示此架構應可用於分析影響醫療產業採用資訊科技/資訊系統的影響因素。

另一方面，專案管理是一件困難的工作，尤其需面對大型資訊專案失敗比率偏高之風險 (McDonald & Eastlack, 1971; The Standish Group, 1995)。例如，有研究估計有九成的 ERP 專案會出現預算超支或時程拖延的情形，而其中更可能有高達五分之一的專案會失敗 (Trunick, 1999)。而在專案執行過程中，預先的專案規劃扮演關鍵的角色。因此，本研究認為，「專案規劃」對機構發展「遠距照護」而言，是一個不容忽視之影響因素。

3. 研究方法

3.1 研究架構與假設

綜觀上述文獻探討，本專案歸納相關研究之實證結果，並認為影響遠距照護導入之關鍵因素，可區分成四大主要構面：組織構面、環境構面、資訊科技構面、專案規劃等構面(如圖 1 所示)。在組織構面方面，包含高階主管支持(Haley, 1997)、醫院任務型態(沈進清, 1993; Bingi et al., 1999)、管理活動需求(Davidson and Chismar, 1999)、資訊科技相關知識(Zielstorff et al., 1993)等因素；在環境構面方面，包含醫療政策(楊澤泉等人, 1997; Chang et al., 2006)、同業競爭(Thong, 1999; Chang et al, 2006)等因素；在遠距照護特性構面方面，包含相容性(Grover, 1993)、相對優勢(Grover, 1993)、供應商(Powell, 1993)等因素；在專案規劃方面，包含專案小組技能(Haley, 1997; Wixom and Watson, 2001)、組織資源配合(Haley, 1997; Wixom and Watson, 2001)與使用者參與(Haley, 1997; Wixom and Watson, 2001)。

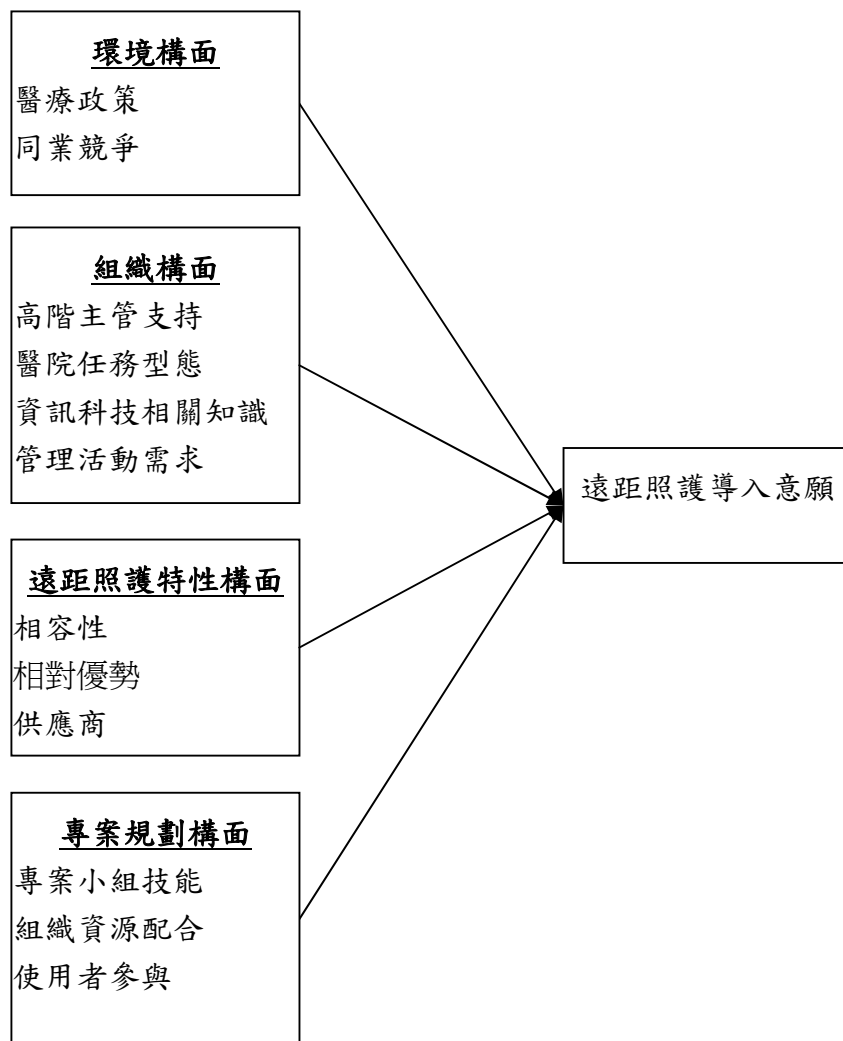


圖 1 研究架構

根據本研究架構，提出假說如下：

- H1.醫療政策會顯著影響導入遠距照護之意願
- H2.同業競爭會顯著影響導入遠距照護之意願
- H3.高階主管支持會顯著影響導入遠距照護之意願
- H4.機構任務型態會顯著影響導入遠距照護之意願
- H5.機構人員對資訊科技相關知識會顯著影響導入遠距照護之意願
- H6.機構管理活動需求會顯著影響導入遠距照護之意願
- H7.科技相容性會顯著影響導入遠距照護之意願
- H8.科技相對優勢會顯著影響導入遠距照護之意願
- H9.科技供應商會顯著影響導入遠距照護之意願
- H10.專案小組技能會顯著影響導入遠距照護之意願
- H11.機構資源配合會顯著影響導入遠距照護之意願
- H12.使用者參與會顯著影響導入遠距照護之意願

3.2 問卷設計與調查方法

本研究以國內照護機構(護理之家等)為研究母體，採用問卷調查法進行，研究對象為機構之管理階層人員。本研究問卷的組成包含三大部分，第一部份為說明頁，文中精要說明本研究之目的與遠距照護之定義與範例，並明確提示須由高階主管或其指定之其他合適中階主管人員來填答。第二部份為問卷填答者基本資料，第三部份為影響導入意願之構面變數問項，包含前述 12 變數及其對應之問項，每一問項均採李克氏五點尺度來衡量。為提高研究信效度，本研究之問卷先經由 TOE 相關文獻探討與遠距照護發展應用相關文獻而來，並經過相關照護領域之兩名學術界博士和兩名照護機構高階主管組成之專家小組討論修訂，問卷初稿完成後再經一位照護機構副院長試填答以進行前測，確保問卷內容之效度。

4. 分析結果

本研究針對衛生署公佈之照護機構名冊進行普查，針對每家機構寄發一份問卷，共計寄發 343 份問卷，扣除歇業者共計寄發 339 份問卷，總計回收 63 份有效問卷，有效回收率為 18.58%。

4.1 填者基本資料分析

在 63 名填答者中包含 41 名高階主管與 22 名中階主管，由此可見填答者具備相當高之代表性，詳細填答者基本資料如表 1 所示。

表 1 填答者基本資料

基本資料	分類	回收份數(百分比)
職位	院長/負責人	25
	其他高階主管	16
	醫護部門之中階幹部	21
	行政部門之中階幹部	1
性別	男	5

	女	58
擔任目前職務年資	2 年(含)以內	9
	2.1~3 年	12
	3.1~5 年	12
	5.1~7 年	11
	7.1~10 年	9
	10 年以上	9
	未填	1
病床數	1-50 床	33
	51-100 床	23
	101-150 床	0
	151-200 床	7

4.2 信效度分析

本研究利用組成式結構方程模式(Components-based Structural Equation Modeling)的 PLS (Partial Least Squares)進行分析。PLS 能同時分析構面間的結構模式以及構面與衡量變數間的衡量模式關係，和其他多變量分析方法相比，PLS 不論在衡量的尺度、樣本數量以及殘差分配上的限制均較低，因此 PLS 是一個有效的分析方法(Chin et al., 2003)。由於本研究有效的樣本數僅為 63，並未達到利用共變異式結構方程模式(Covariance-based SEM)在樣本數上的要求(Hair et al., 1998)，因此採用 PLS 來進行信效度分析與後續推論分析。在變數問項之取捨決策上，本研究依據 Hair et al. (1998)所提供建議，將 factor loading 低於 0.68 的問項刪除，經此步驟後，醫療政策變數留下 2 題問項、同業競爭留下 3 題問項、高階主管支持留下 7 題問項、醫院任務型態留下 4 題問項、資訊科技相關知識留下 6 題問項、管理活動需求留下 4 題問項、相容性留下 3 題問項、相對優勢留下 4 題問項、供應商留下 6 題問項、專案小組技能留下 4 題問項、組織資源配合留下 3 題問項、使用者參與留下 3 題問項。各變數信效度值如表 2 所示，顯示本研究所收集之資料具相當高之可信度。

表 2 信效度分析

變數	Composite Reliability	AVE	Cronbach Alpha
使用者參與	0.952811	0.870865	0.925762
醫療政策	0.873302	0.775253	0.711958
同業競爭	0.838887	0.637094	0.710305
高階主管支持	0.960817	0.779012	0.947656
醫院任務型態	0.943706	0.807792	0.936318
資訊科技相關知識	0.913550	0.638733	0.887272
管理活動需求	0.937851	0.790665	0.916102
相對優勢	0.863840	0.617161	0.824763
供應商	0.927706	0.683861	0.898274
專案小組技能	0.971959	0.896648	0.961836
組織資源配合	0.953579	0.873436	0.937878
相容性	0.840921	0.641763	0.756861

4.3 假說檢定

PLS 結構模型檢定主要是估計路徑係數以及 R Square(R²)值。路徑係數代表研究構念之間關係的強度與方向，而 R² 值指的是外生變數對於內生變數所能解釋變異量的百分比，代表研究模型的解釋能力(Agarwal and Karahanna, 2000)。本研究結構模式與各構念間關係的路徑係數與檢定結果如圖 2 所示，依據 PLS 路徑分析結果顯示，除了「醫療政策」、「醫院任務型態」、「管理活動需求」以及「相對優勢」等構念會顯著影響高階主管對 Telecare

之導入意願外，其餘構念均不顯著，整體模式之解釋力達到 0.459 之水準。由此路徑表亦顯示，本研究所提之假說 H1、H4、H6、H8 得到統計上之支持，整理於表 3。

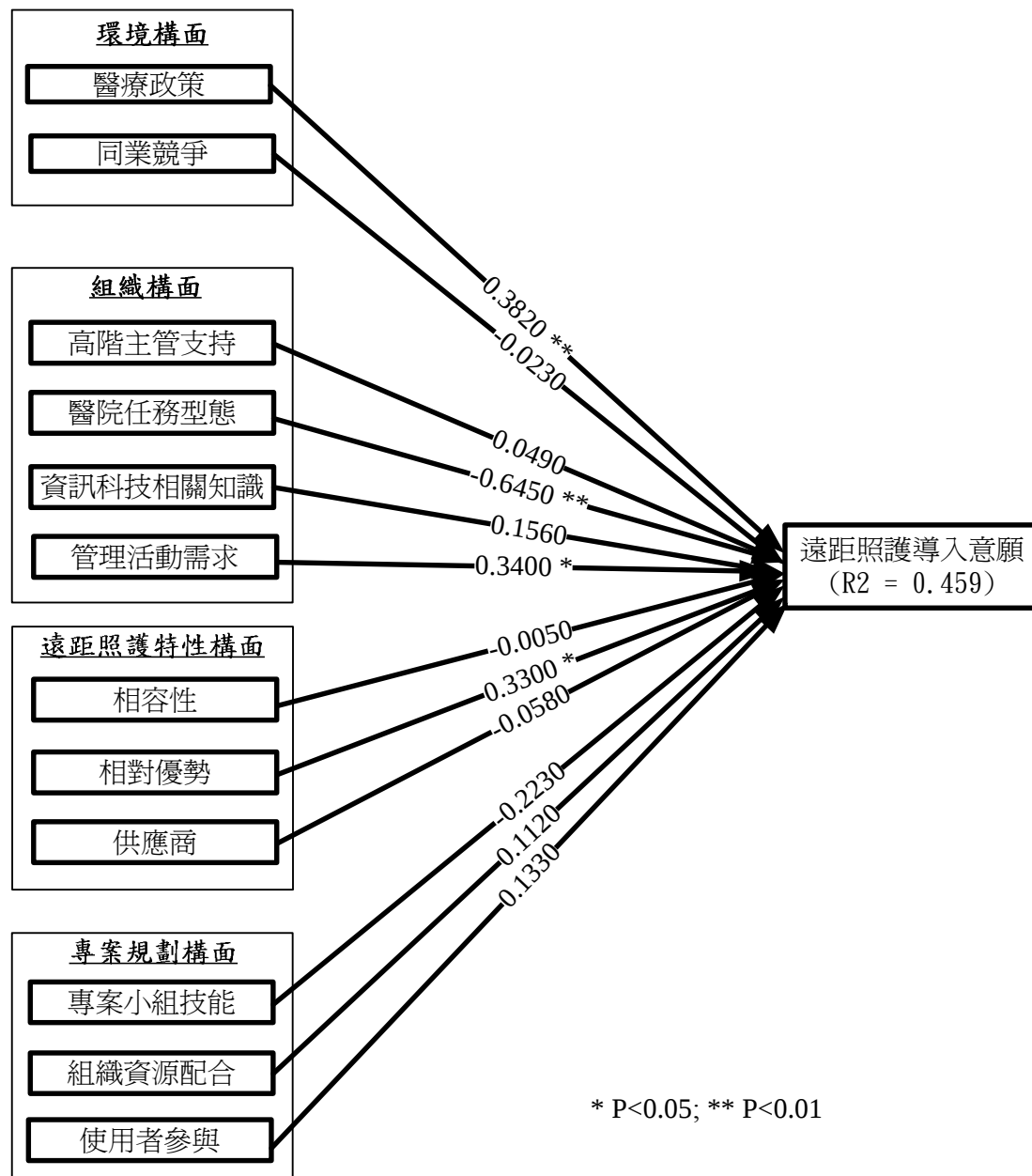


圖 2 PLS

路徑分析結果

表 3 假說檢定結果

假說	檢定結果
H1.醫療政策會顯著影響導入遠距照護之意願	支持
H2.同業競爭會顯著影響導入遠距照護之意願	不支持
H3.高階主管支持會顯著影響導入遠距照護之意願	不支持
H4.機構任務型態會顯著影響導入遠距照護之意願	支持
H5. 機構人員對資訊科技相關知識會顯著影響導入遠距照護之意願	不支持
H6. 機構管理活動需求會顯著影響導入遠距照護之意願	支持

H7.科技相容性會顯著影響導入遠距照護之意願	不支持
H8.科技相對優勢會顯著影響導遠距照護入之意願	支持
H9.科技供應商會顯著影響導入遠距照護之意願	不支持
H10.專案小組技能會顯著影響導入遠距照護之意願	不支持
H11.機構資源配合會顯著影響導入遠距照護之意願	不支持
H12.使用者參與會顯著影響導入遠距照護之意願	不支持

5. 討論與結論

5.1 討論

5.1.1 環境構面對導入 Telecare 意願之影響

由國家投入高額經費積極推動「科技化服務業旗艦計畫—銀髮族 U-Care 旗艦計畫」，以及「數位健康產業發展計畫-遠距照護 (Telecare) 試辦計畫」等相關計畫不難得知，以遠距照護服務模式來創造我國嶄新的經濟產業與照護模式，是國家重要的政策目標。然而導入遠距照護須包含：資通訊設備、生理儀器設備、人員定位與保全設備、以及與醫療機構之資通訊合作，因此建置成本甚高。因此政府相關補助政策與態度，會影響機構導入之意願。

5.1.2 組織構面對導入 Telecare 意願之影響

在組織構面的變數之中，組織任務型態與導入意願呈現反向的關係。此結果顯示，高階主管均不認同，導入 Telecare 的這類大型資訊科技會與機構之任務型態有關。此原因有可能是因為機構之任務相當單純，主要是失能住民之長期照護，在不影響照護品質之下，服務的住民愈多(佔床數愈高愈好)、獲得盈餘愈高，無可諱言的是機構的主要任務，至於教學研究等任務就較不重視。導入大型資訊科技(例如 Telecare)必須投入大量的人力物力資源，其結果反而可能會減少對於提昇組織之組織目標、教學研究目標或服務目標之達成，因此研究統計分析呈現出此反向相關之影響。

相對的，組織的管理活動需求，就顯示出與導入 Telecare 之意願有直接之關係。管理活動包含，提昇個人工作績效、改善照護服務品質、提供正確即時資訊等。許多健康照護的研究均指出，導入資訊科技並無法直接對於創造收入或服務量有關，但卻在醫療照護品質與病人安全上，扮演重要之角色。因此，本研究亦證實此種觀點。

5.1.3 Telecare 特性構面對導入意願之影響

在 Telecare 特性構面中，僅「科技之相對優勢」會影響高階主管導入 Telecare 之意願。此所謂相對優勢包含：提升工作效率、提高照護品質、提升住民(病患)資料的收集與分析、提高與合作醫療或住民家屬之訊息交換等。由於 Telecare 是整合多項科技與服務之整合方案，因此藉由導入 Telecare 來提升本機構對其他機構之相對優勢是可以期待的，因此，本研究結果亦反映此種高階主管之肯定態度，

5.1.4 資訊科技專案計畫構面對導入 Telecare 意願之影響

由國家過去的各種 Telecare 相關的試辦計畫中顯示，對於 Telecare 之大型專案通常是由大型系統整合廠商或醫療機構(醫院)資訊部門來負責專案之規劃與執行，並且由國家(或委託之機構)來監督，因此對於照護機構而言，其反而不需太在意專案計畫之機構之執行，因此本研究亦無法證實資訊科技專案計畫與導入 Telecare 之意願具有顯著之關聯。

5.2 研究限制

本研究為國內外極少數從照護機構管理者角度來探討影響導入 Telecare 意願因素之實證研究，因此無論在學術上或實務上均有其貢獻。唯因問卷回收率不高，因此可能限制了更多可能的研究成果。其次，填答者仍有約三成之比例為中階主管(非高階主管)，因此亦可能影響了樣本之代表性。

5.3 結論與建議

本研究以 TOE 之理論架構，結合專案計畫構面，提出探討影響照護機構主管導入 Telecare 因素之研究架構，而由實證結果指出，政府政策、組織之任務型態與管理活動、Telecare 相對優勢等因素會影響管理者導入 Telecare 之意願。基於本研究的結果，以下提出對於政府、照護機構與後續研究方面之建議：

對於政府而言，擬定長期且明確的遠距照護發展政策與施行方針，仍是機構最為重視的關鍵，包含法規修訂、獎勵措施或政策補助等。唯有明確的政策支持，機構方有意願制定中長期目標來導入 Telecare，並且有效的投入資源來進行，也才能確保導入的成功。

對於照護機構而言，Telecare 是一項所費不貲的投資，因此必須確認發展的項目必須適配於機構的任務型態以及提升機構之相對優勢，否則發展 Telecare 知效益將不明顯。

在後續研究方面，本研究雖然提出包涵 12 個變數之研究架構來探討此議題，然實證結果僅支持 4 個因素會影響機構主管導入 Telecare 之意願，後續學者應能從餘的 8 個不顯著之因素，設計其他的研究來深入探討之。而查證更多影響構面文獻，找出其他的影響因素來探討，進而提升整體模式之解釋能力，也是值得投入之研究議題。另一方面，Telecare 對多數機構而言仍屬嶄新的應用，許多未知或潛在的現象與考量可能須進行深度的個案探討方能累積更完整的知識，此亦提供後續研究者一個思考的研究方向。此外，Telecare 除了本研究涵蓋之護理之家外，為數更多的養護機構(如老人養護所)也可能是遠距照護之潛在需求者，因此未來可以納入養護機構為研究對象，研究結果並可與護理之家做比較，相信對於政府發展 Telecare 而言，會更具有參考之價值。而除了以組織角度來探討導入意願外，以個人角度並參考科技接受相關理論 (Davis et al., 1989; Venkatesh and Davis, 2000; Venkatesh et al., 2003; Venkatesh, V. & Bala, H., 2008)，來探討 Telecare 的使用意願或接受程度，亦是重要的研究議題。

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計畫成果自評

本計畫之目的在以組織之角度，探討影響照護機構導入 Telecare 意願之因素，主要是以照護機構之主管為調查對象。本研究參考相關文獻，提出整合研究架構，並就計畫內所提出之假說予以檢定驗證。本研究之成果與貢獻，可歸納為學術界及實務界兩方面。在學術上，以往 Telecare 相關研究多著重在創新科技之設計與使用，較少從組織面與管理面來探討影響導入 Telecare 之因素，尤其在主要的潛在使用者—照護機構(護理之家)。因此，本研究所提出之模式與研究成果，具有學術上之價值。而在實務上，衛生署與產業界均持續推動「遠距照護產業」之發展，期望建立台灣另一個具世界優勢的產業。因此，無論是對

政府或遠距照護相關產業，本研究均可有相當正面的參考價值。本研究成果適合在學術期刊發表，目前主持人正著手將部分研究成果於相關研討會發表，待收集更多意見與資料後，亦會準備投稿學術期刊。

另外，本計畫培養參與研究之碩士學生之實證研究的能力，並且增加與實務界互動的機會。研究成果亦對嘉南藥理科技大學資訊管理系、醫務管理系以及醫療資訊管理研究所的學術與實務研究能力有正面的幫助，研究成果可透後續之產官學合作管道來做推廣與應用。

可供推廣之研發成果資料表

☐ 可申請專利

☐ 可技術移轉

日期：98 年 10 月 28 日

國科會補助計畫	計畫名稱：影響遠距照護系統接受意向因素之研究-居家式與機構式使用者之觀點 計畫主持人：劉忠峰 計畫編號：NSC 97-2410-H-041 -007- 學門領域：資訊管理
技術/創作名稱	影響照護機構導入遠距照護意願之因素之研究
發明人/創作人	劉忠峰
技術說明	中文： 本研究提出一個探討「影響照護機構導入遠距照護意願之因素」之研究架構與研究方法，並予以實證。
	英文： The purpose of this research is to propose and validate an integrated research model based on the TOE constructs to explore the factors affecting the intention of adopting Telecare in healthcare Institutions' managers' views.
可利用之產業及可開發之產品	醫療照護產業
技術特點	國內外極少數用實證的方式以主管之觀點來探討影響照護機構導入 Telecare 之因素，因此具有學術上與實務上之參考價值。
推廣及運用的價值	本模式可作為政府與醫療照護機構在發展 Telecare 之參考，具有推廣與運用之價值。

※ 1. 每項研發成果請填寫一式二份，一份隨成果報告送繳本會，一份送 貴單位研發成果推廣單位（如技術移轉中心）。

※ 2. 本項研發成果若尚未申請專利，請勿揭露可申請專利之主要內容。

※ 3. 本表若不敷使用，請自行影印使用。

出席國際學術會議心得報告及發表之論文各一份

一、心得

本次主持人出席98年6月18-20日於泰國曼谷舉行之「Technology Innovation and Industrial Management 2009 (TIIM 2009)」，並發表95年度主持之國科會計劃成果論文乙篇，題目為：「Exploring Factors Affecting Nursing e-Learning Success Based on Information System Success Model」。本次主持人除了出席各場論文發表會之外，大會亦安排專題演講，包含：Apichati Sivayathorn, MD. Chief Quality Officer, Bumrungrad International Hospital “Journey towards Quality Excellence”，此對於主持人與研究團隊從事醫療照護、國際醫療與遠距醫療之研究深具參考價值。

二、論文內容

EXPLORING FACTORS AFFECTING NURSING E-LEARNING SUCCESS BASED ON INFORMATION SYSTEM SUCCESS MODEL

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ABSTRACT

E-Learning is thought of as an innovative approach to enhance nurses' care service knowledge. Extensive research has provided rich information toward system development, courses design and nurses' satisfaction with an e-Learning system. However, a comprehensive view in understanding nursing e-Learning system success is an important but less focused-on topic. The purpose of this research is to explore nurses' e-Learning system use intention and satisfaction relating to net benefits based on the modified DeLone and McLean's Information System Success Model (ISSM). The study used a structured, self-administered questionnaire and collected 208 valid nurses' responses from 21 of Taiwan's mid-and-large-scale hospitals (i.e. medical centers and regional hospitals) that have implemented nursing e-Learning systems. The result, after structural equation modeling (SEM) analysis, confirms that the ISSM is sufficient to explore the nurses' e-Learning use in terms of "Intention to Use," "User Satisfaction" and "Net Benefits." However, while the three exogenous quality factors (System Quality, Information Quality and Service Quality) were all found to be critical factors affecting "User Satisfaction," only "Information Quality" showed a direct impact on the "Intention to Use" the e-Learning system. This study provides useful insights for evaluating nursing e-Learning qualities as well as an understanding of nurses' intentions and satisfaction related to performance benefits.

Keywords: Nursing, e-Learning Systems, Satisfaction, Intention, Information System Success Model

INTRODUCTION

Enterprises regard "e-Learning" as a way to gain more information, effectively reduce

training costs, and enhance learning results without time and space constraints (Shachtman, 2000; Fletcher, 2004; Nelson, 2003; Carnwell, 2000; Marki et al., 2000). Thus, organizations have established numerous internet- and multimedia-based learning systems. With the prevalence of the internet, e-Learning is not only a web-based information system but also a crucial change in education methods (Keller & Cernerud, 2002).

Medical organizations have always considered ongoing training as an important activity. Hospitals expect nursing personnel to possess greater expertise due to the changeful regulations of National Health Insurance System and continuous adoption of advanced medical technology. These medical professionals need to tackle complicated tasks with urgency, so they have to learn a great deal of practical knowledge in a limited period of time to meet job needs (Young, 2003).

In most hospitals, nurse staffing is tight and the three-shift system makes traditional classroom (face-to-face) learning difficult to achieve. E-Learning can compensate for these problems in nurses' education. According to a latest national investigation conducted under Department of Health authorization (Hwang et al., 2005), 24.2 % of regional hospitals and up to 68.4 % of medical centers have adopted e-Learning in Taiwan, revealing a growing tendency for e-Learning-based professional nursing training. Many e-Learning-related studies have focused on technical aspects or course design; relatively few studies have examined the effectiveness and impact of e-Learning on nursing personnel from the perspective of "information system success." Therefore, this study examined at depth factors for successfully using nursing e-Learning systems, as well as the impact on "Intention to Use," "User Satisfaction," and "Net Benefits," based on the "IS Success Model" developed by DeLone & McLean (2003).

LITERATURE REVIEW

Information Systems Success Model

In 1992, DeLone & McLean introduced the well-known "Information Systems Success Model," which covers six evaluation indicators and the relationship between indicators. According to that study, six constructs influence "IS Success," including "System Quality," "Information Quality," "System Use," "User Satisfaction," "Individual Impact," and "Organizational Impact." The prevalence of PCs, complex business information systems, and booming information technology outsourcing have produced a remarkable change in users' attitudes toward using information systems. The support and service for specific information systems provided by their company or contractor, principally influences users' satisfaction and their intention to use the systems. Therefore, based on IS Success Model studies over the past decade, DeLone & McLean proposed a modified IS Success framework by introducing the "Service Quality" construct.

In DeLone & McLean's updated model proposed in 2003, "Individual Impact" and "Organizational Impact" are incorporated into "Net Benefits" to reveal use of information systems influence. DeLone & McLean still held that "Intention to Use" would be a better evaluation indicator than "Use." Many researchers conducted IS Success studies from a variety of perspectives, but the framework proposed by DeLone & McLean remains the most mentioned and adopted.

Nursing e-Learning

E-Learning has been defined in many ways by numerous scholars (such as Khan, 1997; Hall, 1997; Keller & Cernerud, 2002; Clark & Mayer, 2003; 2007). Clark & Mayer (2003) introduced a rather complete definition describing e-Learning as “training delivered on a computer (including CD-ROM, Internet, or Intranet) that is designed to support individual learning or organizational performance goals.” Clark & Mayer (2003) proposed four design features for e-Learning. An effective e-Learning design 1) includes content relevant to the learning objective; 2) uses instructional methods such as examples and practice to help learning; 3) uses media elements such as words and pictures to deliver the content and methods; 4) builds new knowledge and skills linked to individual learning goals or to improved organizational performance.

Using Clark & Mayer’s viewpoint, this study defines a nursing e-Learning system as “an information system that supports nursing personnel learning and training via internet or intranet in healthcare organizations.” Based on this definition, such a system covers current e-Learning activities like training for a clinical ladder program, case studies, and healthcare education programs.

METHODOLOGY

Research Framework

After reviewing numerous IS-Success-related studies, DeLone & McLean proposed the well-known IS Success Model. This study set up a research framework enlightened by nursing- and information-management-related literature with proper evaluation variables chosen by experts and scholars from academic and practical circles (see Figure 1). This research adopted DeLone & McLean’s view to use “Intention to Use” instead of “Actual Use” for predicting IS success.

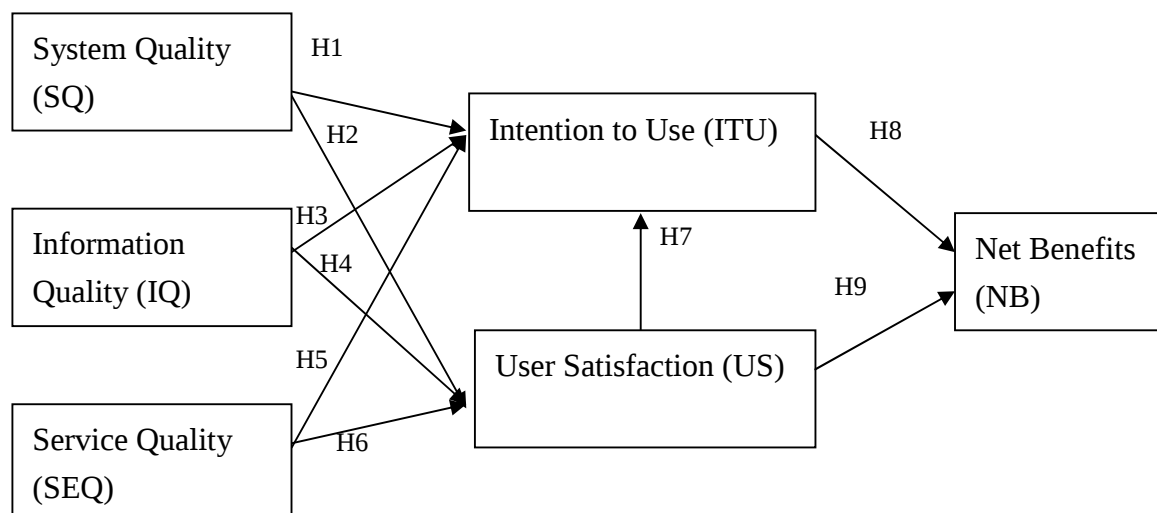


Figure 1. Research Framework

Research Hypotheses

In this study, “Net Benefits” of nursing e-Learning is thought to be influenced by “Intention to Use” and “User Satisfaction.” “Intention to Use” also impacts “User Satisfaction.” Nursing personnel’s intention and degree of satisfaction toward e-Learning are both influenced by three constructs: “System Quality,” “Information Quality,” and “Service Quality.” Therefore, this study puts forward the following hypotheses:

H₁: In a nursing e-Learning system, “Service Quality” significantly influences “Intention to Use.”

H₂: In a nursing e-Learning system, “Service Quality” significantly influences “User Satisfaction.”

H₃: In a nursing e-Learning system, “Information Quality” significantly influences “Intention to Use.”

H₄: In a nursing e-Learning system, “Information Quality” significantly influences “User Satisfaction.”

H₅: In a nursing e-Learning system, “Service Quality” significantly influences “Intention to Use.”

H₆: In a nursing e-Learning system, “Service Quality” significantly influences “User Satisfaction.”

H₇: In a nursing e-Learning system, “User Satisfaction” significantly influences “Intention to Use.”

H₈: In a nursing e-Learning system, “Intention to Use” significantly influences “Net Benefits.”

H₉: In a nursing e-Learning system, “User Satisfaction” significantly influences “Net Benefits.”

Variables and Operational Definitions

This study deduced constructs and variables by compiling information from previously mentioned literature (DeLone & McLean, 1992; 2003) and comments made by experts and scholars. Exogenous variables encompass “System Quality,” “Information Quality,” and “Service Quality,” while endogenous variables include “Intention to Use,” “User Satisfaction,” and “Net Benefits.” The questionnaire had 15 questions designed to cover the six constructs. Please refer to Table 1 for the compilation of constructs and operational definitions.

Table 1. Six Constructs and Operational Definitions

Construct	Variable	Operational Definition
System Quality (SQ)	Ease of use	An e-Learning system is easy to learn and takes little effort to master.
	Reliability	An e-Learning system seldom delays training due to a software or hardware crash or error.
	Usability	An e-Learning system provides pertinent service to facilitate daily training.
	Response time	An e-Learning system features quick responses, so long waiting will not hamper the learning activity.
Information Quality (IQ)	Completeness	An e-Learning system provides complete information that is relevant to the training.
	Accuracy	An e-Learning system provides accurate training information.
	timeliness	E-Learning provides timely and needed training information.
	Security	An e-Learning system protects learners' personal information from illegal disclosure.
Service Quality (SEQ)	Responsiveness	Information personnel immediately help nursing personnel with problems and requests regarding the e-Learning system.
	Assurance	Information personnel clearly understand nursing personnel's needs when using the e-Learning system.
	Empathy	In a nursing e-Learning system, the information personnel have nursing personnel's best interests at heart
Intention to Use (ITU)	Availability	Nursing personnel know the e-Learning system is easily available.
	Necessity	Nursing personnel feel the e-Learning system is necessary.
User Satisfaction (US)	Overall satisfaction	Overall, nursing personnel are satisfied when using the e-Learning system.
Net Benefits (NB)	Incremental efficiency	Using the e-Learning system increases nurse training efficiency.
	Incremental effectiveness	Using the e-Learning system increases nurse training effectiveness.
	Time savings	Using the e-Learning system takes less time to train nursing personnel.

This survey adopted a 5-point Likert scale, the content of which was based on questionnaire samples and pertinent theories proposed and verified by earlier researchers. A professor from the information management field and two experts and scholars from the nursing field examined the first draft of the questionnaire. Five eligible nurses from a regional hospital completed a pre-test revised questionnaire to help discover and correct underlying problems in the questionnaire.

RESULTS

Descriptive Statistics

The study data was collected from Taiwan's regional hospitals and medical centers. A certain number of questionnaires (10 to each regional hospital and 15 to each medical center) were distributed to nursing department directors. We asked them to choose eligible respondents

(nursing personnel who had experienced e-Learning) and send back the responses. Instructions indicated questionnaires should not be completed if the hospital had no nursing e-Learning system. This research collected 208 valid responses from 21 hospitals: 91(43.75%) from 9 medical centers and 117(56.25%) from 11 regional hospitals. There are 101 regional hospitals and medical centers in Taiwan, so the response rate was 20.79%.

More than half of participants were senior nursing personnel with 11 years of work experience. Responses indicate nursing personnel do not make use of e-Learning frequently; up to 75.00 % of them only use a system one to three times a week. In addition, results reveal that teaching-material searching and reading, online tests, and knowledge management (document management) are the most common functions in e-Learning systems. The descriptive statistics are illustrated in Table 2 and Table 3.

Table 2. Description of the participants

Background	Category	Number of responses (%)
Age	30 years old or younger	65(31.25%)
	31-40 years old	98(47.12%)
	41-50 years old	39(18.75%)
	51 years old or older	6(2.88%)
Title	Management Personnel	62(29.81%)
	General Personnel	146(70.19%)
Years of work experience in the current position	Less than 2 years	31(14.90%)
	3-5 years	71(34.13%)
	6-10 years	59(28.37%)
	11-15 years	25(12.02%)
	More than 16 years	22(10.58%)
Years of work experience in the nursing field	Less than 2 years	8(3.85%)
	3-5 years	32(15.38%)
	6-10 years	62(29.81%)
	11-15 years	56(26.92%)
	More than 16 years	50(24.04%)
Computer-use	1-3 years	20(9.62%)
	4-6 years	40(19.23%)
	7-9 years	49(23.56%)
	More than 10 years	99(47.60%)
Average use of e-Learning per week	1-3 times	156(75.00%)
	4-6 times	21(10.10%)
	7-9 times	6(2.88%)
	More than 10 times	25(12.02%)

Table 3. Description of e-Learning functions

Functions of nursing e-Learning	Number of responses (see <i>Note</i>)
Learning material searching and reading	162
Online test	137

Online discussion	66
Online Q & A	79
Statistical calculation	44
Knowledge management (document management)	118

Note: Each respondent may identify one or more e-Learning functions

Study Reliability and Validity

Before the data analysis stage could occur, raw data from the completed questionnaires was examined for reliability and validity. Careful literature reviews and an expert panel as well as pretesting ensured data validity. Cronbach's α was used to examine reliability. The α values of the variables ranging from 0.75 to 0.94 indicate the data is highly reliable (Hair, 1998).

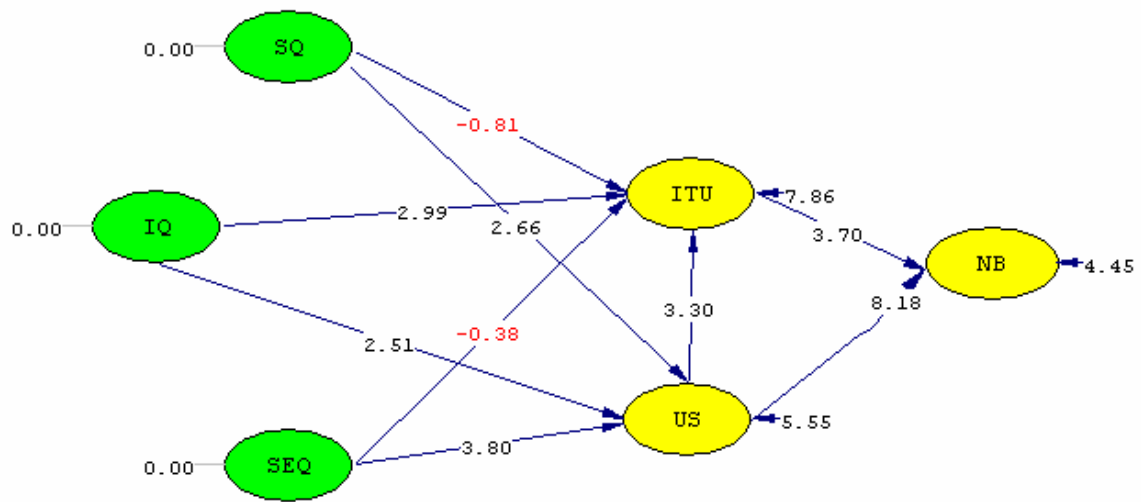
Hypothesis Testing

In the Structural Equation Modeling (SEM) analysis, analyzing goodness of fit and examining explanatory power on the research model should be done first. Based upon arguments made by Bentler (1989), Bentler (1992), and Hu & Bentler (1999), five indicators were selected to conduct an overall evaluation on the goodness of fit. Table 4 presents the evaluation results. Analysis reveals the goodness of fit of the research model is acceptable.

Table 4. Goodness of Fit Analysis on the Research Model

Indicators	Values	References
$\chi^2 / \text{d.f.}$	1.976	<5 (Bentler, 1989)
Goodness of Fit Index (GFI)	0.88	≥ 0.9 (Bentler, 1989)
Root Mean Square Error of Residual Approximation (RMSEA)	0.069	≤ 0.06 (Hu & Bentler, 1999)
Normed Fit Index (NFI)	0.96	≥ 0.9 (Bentler & Bonett, 1992)
Comparative Fit Index (CFI)	0.98	≥ 0.95 (Bentler, 1989)

Figure 2, the path diagram of the structural model, shows that nursing personnel's "Intention to Use" is influenced only by "Information Quality." Nursing personnel's "User Satisfaction" with and the "Intention to Use" the nursing e-Learning system influences training effect and produces "Net Benefits." "User Satisfaction" influences "Intention to Use." Furthermore, the three exogenous variables "Service Quality," "Information Quality" and "Service Quality" of e-Learning systems retain their significant influence on "User Satisfaction," but only "Information Quality" influences "Intention to Use." Table 5 shows the results of hypothesis testing.



Chi-Square=243.97, df=123, P-value=0.00000, RMSEA=0.069

Figure 2. Structural Equation Modeling Result

Table 5. Results of Hypothesis Testing

Hypothesis	Result
H ₁ : In a nursing e-Learning system, “Service Quality” significantly influences “Intention to Use.”	Not Supported
H ₂ : In a nursing e-Learning system, “Service Quality” significantly influences “User Satisfaction.”	Supported
H ₃ : In a nursing e-Learning system, “Information Quality” significantly influences “Intention to Use.”	Supported
H ₄ : In a nursing e-Learning system, “Information Quality” significantly influences “User Satisfaction.”	Supported
H ₅ : In a nursing e-Learning system, “Service Quality” significantly influences “Intention to Use.”	Not Supported
H ₆ : In a nursing e-Learning system, “Service Quality” significantly influences “User Satisfaction.”	Supported
H ₇ : In a nursing e-Learning system, “User Satisfaction” significantly influences “Intention to Use.”	Supported
H ₈ : In a nursing e-Learning system, “Intention to Use” significantly influences “Net Benefits.”	Supported
H ₉ : In a nursing e-Learning system, “User Satisfaction” significantly influences “Net Benefits.”	Supported

DISCUSSION

Quality factors Affecting Nurses’ Satisfaction and Use Intention of e-Learning

Figure 2, the Structural Equation Modeling Results, indicates that all the three exogenous variables (System Quality, Information Quality, and Service Quality) significantly influence

“User Satisfaction” with nursing e-Learning. Shachtman (2000) held that an online classroom is good in that it provides learners with an environment for self-learning, saves time and cost, and updates teaching materials with ease. After researching the use of e-Learning systems among registered nurses, Attack (2003) suggested that organizations carefully evaluate computer skills, computer access, and the learning environment when preparing for nursing web-based learning.

Kenny’s focus group study (2002) on nursing students’ online-learning use concluded that computer confidence, flexibility, active learning and practicalities of teaching contribute to student frustration or satisfaction with online learning. The Kenny study also showed that technical support was vital for reducing anxiety when students experience problems. These study results imply that “System Quality,” “Information Quality” and “Service Quality” (covering interface user-friendliness, function completeness, system stability, and technical support from external personnel), significantly influence “User Satisfaction” with a nursing e-Learning system. Due to the diversity of nursing personnel information literacy, information personnel and/or other technical support staff can greatly increase nursing personnel satisfaction if they express interest in users’ success, help them solve problems, and offer real-time service when users of a nursing e-Learning system have trouble. This current study supports this conclusion.

By contrast, in this current study, the exogenous variables of “System Quality” and “Service Quality” did not show significant impact on “Intention to Use.” A possible explanation is that nurses’ learning and training concerns are for increasing knowledge and enhancing practical skills that an e-Learning system cannot accomplish alone. That is, these staff mainly regard e-Learning as a kind of auxiliary tool. Commonly, nurses are encouraged but not enforced to use e-Learning.

E-Learning and traditional classroom learning do not show significant differences in learning outcomes. For example, in one study, nurses passed nursing care skill tests regardless of the training method (e-Learning or traditional classroom programs) (Chang et al., 2008). Consequently, the content (information) a system provides is the principal influence on nurses’ intention to use e-Learning rather than service or system qualities.

Nurses’ Satisfaction and Intention Affects Net Benefits of e-Learning

DeLone & McLean (1992, 2003) pointed out that the personal degree of satisfaction with and use intention of the information system positively influenced the individual and the organization, that is, it had a significant relationship with “Net Benefits.” Recent related studies revealed that nurses usually felt satisfied or very satisfied with e-Learning courses and showed a positive willingness to use e-Learning. This current study also confirmed that nurses’ satisfaction and use intention for the e-Learning system had a significant impact on net learning benefits. The IS Success Model was validated as a powerful basis for exploring nursing e-Learning.

User satisfaction has the potential of being an important driving force to increase user’s use intention for technology use (DeLone & McLean, 2003) or continued use (Bhattacharjee, 2001). This study of nursing e-Learning confirmed this relationship. Therefore, top-management should carefully consider how to promote e-Learning benefits and make a continuous plan to satisfy nurses’ needs for a hospital’s long-term nursing education program. Of course, high quality service support and system maintenance are critical factors for making this aim come true.

CONCLUSION

Internet technology is real-time and flexible. It has gradually become one of the most important channels for spreading information and knowledge. However, the nature of the nursing field is so special that the influencing factors for introducing e-Learning systems and evaluating the degree of satisfaction differ from general information systems. In this study, only information quality of e-Learning systems displays a direct and significant relationship with nurses' use intentions. This result differs with studies probing the IS Success Model by scholars from the information management field. This difference implies service quality and system quality are not currently the first concerns in whether or not they will use e-Learning. One of the most plausible reasons for explanation is that nursing e-Learning is commonly regarded as a voluntary activity. As a result, the usage frequency of e-Learning is low for heavy-load nurses. This study also reflects the same phenomenon.

In the nursing learning context, some studies suggest that integrating e-learning and traditional face-to-face instruction is useful for enhancing healthcare knowledge, reducing the lecturing time and cost (Sung et al., 2008). An integrated curriculum design could raise nursing personnel's intention to use a nursing e-Learning system and the following benefits be further boosted. In this way, new verification may be able to support the model proposed by DeLone & McLean (2003).

Nursing e-Learning is still in a beginning stage with many uncertain factors and issues to be clarified, investigated and overcome. Investigating these factors and issues would contribute to the comprehensiveness and amplitude of the IS Success Model in nursing e-learning use. Other constructs and indicators, such as information culture (Curry & Moore, 2003) as well as other theoretical models, such as the Technology Acceptance Model (Davis, 1989; Venkatesh et al., 2003), Technology-Task Fit (Goodhue, 1995) and Innovation Diffusion Theory (Rogers, 2003) could modify and enhance this research framework. Such extended or integrated approaches may provide additional insights to understanding nursing e-Learning use. Academic and practical researchers need ongoing experiencing and advance exploring in nursing e-Learning in order to solidify the framework with broader explanations.

Finally, we acknowledge the following limitations. The research subjects were medium- and large-scale medical institutions, and small-scale hospitals, which meant a great number of institutions were excluded. This could have affected the representativeness of this study. The major reason, however, is that only a few small-scale hospitals (Hwang et al., 2005) have adopted e-Learning systems. In addition, the questionnaire response rate from hospitals was just 20.79%, which cannot represent the whole population.

ACKNOWLEDGEMENTS

Sincere thanks and recognition are given to National Science Council of Taiwan for funding this study (NSC 96-2416-H-041 -001).

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