A Network Meta-Analysis on the Effects of Information Technology Application on Preoperative Knowledge of Patients

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Abstract—**The application of information technology in health education plan in Taiwan had gone for a long time. This study was performed to synthesize existing research comparing the effects of information technology application versus traditional instruction in health education plan on patients' knowledge in Taiwan. In spite of claims regarding the potential benefits of using information technology in health education plan, research results comparing the effects of information technology application and traditional instruction in Taiwan were conflicting. Meta-analysis was a statistical process whereby the findings of several studies, focusing on a common problem or topic, are pooled in an effort to draw inferences as to the meaning of a collective body of research. The results of this study indicate that information technology application in health education plan had moderately effects on patients' knowledge over traditional health education plan in Taiwan. The results of this study indicate that information technology application (interactive-technology, multimedia, and video) in health education plan had moderately effects on patients' knowledge over traditional health education plan (leaflet therapy) in Taiwan. The results from this study suggest information technology application on health education is positive with patients' knowledge. This study compared the effects of traditional health education plan (leaflet therapy) on preoperative knowledge of patients with the therapy of interactive-technology, multimedia, video, group-interactive, and no-measures. It could find that the effects of interactive-technology therapy were better than others, and video therapy was the second.**

Keywords- Health education plan, healthcare, patients' knowledge, network meta-analysis

I. INTRODUCTION

The application of information technology in healthcare in Taiwan had gone for a long time. The need to improve the health care system has led to the launch of a national initiative that stresses the use of health information technologies to enhance quality of care, support health care safety, and provide cost-effective health services for consumers, such as patients or individuals who receive medical care. While much of the discussion has focused on how health care organizations such as hospitals need to adopt health information technologies for patient safety, there is a growing recognition that such technologies can be used directly by consumers to acquire new forms of health care, such as telehomecare or eHealth. When used by patients, these technologies are referred to as consumer health information technologies [1]. Several definitions describing health information technologies can be found. Consumer health information technologies are defined as computer-based systems that are designed to facilitate information access and exchange, enhance decision making, provide social and emotional support, and help behavior changes that promote health and well-being [2].

While the potential for using information technology application to improve health care has been acknowledged, these technologies are still not always accepted by patients for variety of reasons, including poor device usability, insufficient training on how to use the technology, lack of computer skills, and low self-efficacy [3, 4, 5]. This is a significant concern for patients and health care organizations; patients who reject information technology application would not benefit from them, and rejection means a loss of return on investment for health care organizations. This concern has been realized. Evidence shows that substantial numbers of potential users do not accept information technology application and this has led to technology implementation failure in several projects [5]. Therefore, studies that examine variables predicting patient information technology application acceptance are needed.

It was important to define these approaches to ensure proper selection of appropriate studies. Information technology application, depending on their purposes, may be used by healthy individuals seeking out health information or by injured individuals for treatment or self-management. This latter group was the current population of interest because information technology application acceptance may directly affect their health and well-being. It could be referred to this group actively receiving medical care for an injury or illness as patients. Acceptance of technology has been defined in four primary ways: satisfaction with the technology, use or adoption of the technology, efficient or effective use of the technology, and intention or willingness to use the technology [6, 7, 8]. Therefore, our definition of information technology application acceptance is limited to those four conceptualizations. As described earlier, consumer health information technologies on

which this article focuses are patient-oriented computer-based systems used to promote health, well-being, and safety, including telemedicine, e-health, and Web-based health technologies.

In spite of claims regarding the potential benefits of information technology application in health education, research results comparing the effects of information technology application and traditional instruction in health education in Taiwan are conflicting. Meta-analysis was a statistical process whereby the findings of several studies, focusing on a common problem or topic, are pooled in an effort to draw inferences as to the meaning of a collective body of research [9]. Early meta-analysis studies were published prior to the microcomputer revolution, since 1970. In an effort to lend data to this debate, this study provides the meta-analysis verse traditional instruction in health education in patients' knowledge.

II. MATERIALS AND METHODOLOGY

A. Research Frame

The research methodology implicated in this study was the meta-analytic approach which was similar to that suggested by Higgins, Thompson, Deeks, and Altman [10]. Their approach requires a reviewer to locate studies through objective and replicable searches, code the studies for salient features, describe outcomes on a common scale, and use statistical methods to relate study features to outcomes. This approach requires the reviewer to use objective procedures for locating studies, use quantitative techniques to describe study features and outcomes, and use statistical methods to summarize overall findings and explore relationships between study features and outcomes. The research framework of this study was as Figure 1. H1 is information technology application with health education is negative with patients' knowledge.

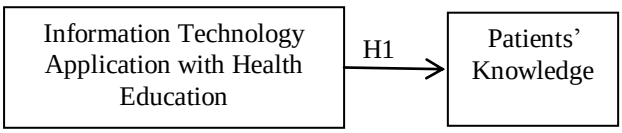

Figure 1. Research framework of this study

B. Research Data

These studies considered for use in this meta-analysis came from Taiwan Theses and Dissertations Knowledge Value-Added System. 36 theses were located through this search procedure. They include 36 studies for patients' knowledge.

Several criteria were established for inclusion of studies in the present analysis as:

1. The study had to compare the effects of information technology application and traditional instruction in health education plan on patients' knowledge.
2. The study had to provide quantitative results from both information technology application and traditional instruction in health education plan classes.
3. The study had to use Taiwan patients as subjects.
4. The study could be obtained with full-text.

Taiwan Theses and Dissertations Knowledge Value-Added System was the project entrusted to Taiwanese National Central Library (NCL) by the Department of Higher Education of The Ministry of Education in Taiwan. As recalling to the past efforts of theses and dissertations related information gathering, NCL started editing and printing of Catalog of Theses and Dissertations in Taiwan in 1970. Taiwanese NCL has implemented the specific plan of theses and dissertations abstracts nationwide since 1994 by establishing abstracts files of theses and dissertations and launched web version of on-line search system which got very good feedback about positive value by various fields in 1987. In 1998, it also established theses and dissertations abstracts online system with the financial support by The Ministry of Education in Taiwan. Taiwanese NCL held the opening ceremony of National Theses and Dissertations Abstract File Building Plan which set up another new milestone on formal internet service of theses and dissertations. After 2000, Taiwanese NCL added functions of uploading of full text electronic theses and dissertations and online printing of authorization papers in addition to above mentioned National Theses and Dissertations Abstract File Building Plan. Thus Taiwanese NCL integrated the existing collaborative production and sharing of on-line database of National Theses and Dissertations information network [11].

C. Data Analysis

Meta-analysis was originally created by Glass, McGaw, and Smith [12]. In relating it to existing analyses, it could be classified research analysis into primary analysis, secondary analysis, and meta-analysis. Primary analysis is the original analysis of raw data. Secondary analysis uses alternative analytical techniques to analyze the same data to answer the same research questions, or uses the same techniques to answer different questions from the same data. A meta-analysis encompasses results of studies that are already conducted. It did not use the term to refer to the analysis of a planned series of investigations. Purpose of a meta-analysis was not simply to summarize a whole body of literature with a single effect size or overall significance level. It also tried to determine how study features influence effect sizes.

The effectiveness of information technology application in health education and training was determined by the overall effect of the treatment. Meta-analytic procedures were applied to calculate the size of this effect. As the meta-analysis progressed, and results unfolded, studies were grouped according to their common study features, and the various categories within the features were identified. Since a meta-analysis synthesizes the statistical results from many different studies, it is not necessary to define the independent variable in very specific terms. For this meta-analysis, it was sufficient to state the independent variable as the teaching method in technical education and training, which could be either computer-assisted instruction or traditional instruction. For the same reason, it was adequate to begin the meta-analysis by defining the dependent variable as student learning or achievement in learning resulting from technical education and training, as measured by some test or tests.

Meta-analysis combines statistical results with fixed effect or random effect.

With fixed effect, meta-analysis assumes that the true effect size each study is trying to estimate is the same across all the studies. There will be differences in the estimates each study arrives at, but these are attributed to chance/random variations.

The fixed effect (θ_{IV}) was combined into weighted average (W_i) with inverse-variance method in this study. Pooled estimate is weighted average with inverse-variance method [13] as

$$\theta_{IV} = \frac{\sum_{i}^{N} W_i \theta_i}{\sum_{i}^{N} W_i} \quad (1)$$

weights are inverse of variance as

$$W_i = \frac{1}{SE(\theta_i)^2} \quad (2)$$

Standard error of pooled estimate with inverse-variance method as

$$SE(\theta_{IV}) = \frac{1}{\sqrt{\sum_{i}^{N} W_i}} \quad (3)$$

Heterogeneity (between-study variability) measured by

$$Q = \sum_{i}^{N} W_i (\theta_i - \theta_{IV})^2 \quad (4)$$

Advantages of inverse-variance method are maximizes precision of pooled estimate Θ_{IV}, and Most importantly it is applicable to a wide range of outcome types and study types. The disadvantage of inverse-variance method is poor results when event rates are low or studies are very small.

With random effect, meta-analysis incorporates an estimate of the between study variation by relaxing the assumption of that there is one true effect. True effect sizes for each study are assumed to come from a distribution of answers that will vary from study to study. The right answer that one study is trying to estimate will be different from the right answer for another study. The pooled estimate from the meta-analysis is the mean of this distribution of right answers.

The random effect pooled estimate is weighted average with DerSimonian & Laird method [14] as

$$\theta_{DL} = \frac{\sum_{i} W'_i \theta_i}{\sum_{i} W'_i} \quad (5)$$

Weights used for the pooled estimate are similar to the inverse-variance, but now incorporate a component for between-study variation:

$$W'_i = \frac{1}{SE(\theta_i)^2 + \tau^2} \quad (6)$$

DerSimonian & Laird method in random effect method, assumption that there is a single true answer that all studies are trying to estimate is relaxed. Now assume that each study has a different true answer that they are trying to estimate. Assume true effect sizes Θ i have a normal distribution with mean Θ and variance τ^2. τ^2 is the between-study variance.

Between study variance as

$$\tau^2 = \frac{Q - (k-1)}{\sum_{i}^{N} W_i - \left(\frac{\sum_{i}^{N} W_i^2}{\sum_{i}^{N} W_i}\right)} \quad (7)$$

Where:

w_i are the weights from the fixed effect inverse-variance method

Q is the heterogeneity test statistic from before (either from inverse-variance method or Mantel-Haenszel method)

k is the number of studies

τ^2 is set to zero if Q<k-1

Ensures the test statistic Q has nice distributional properties, so that p-values can be derived from standard tables. Look up Q in tables of the chi-squared distribution on k-1 degrees of freedom. The null hypothesis is that the true effect size is the same for all studies. A statistically significant result means that there is strong evidence against there being one common effect size, so we take it that there is heterogeneity.

When there is little heterogeneity, so Q is smaller than k-1, τ^2=0 and the weights are the same as the inverse variance method. When τ^2>0 the weights are smaller and more similar to each other than in a fixed effect model. Because the weights are smaller, the sum of weights will be smaller, and the so the SE will be bigger, and p-values less significant. Small studies will have relatively greater influence.

Advantages of DerSimonian & Laird method are as widely applicable as the inverse-variance fixed effect model, and incorporate heterogeneity into the model. Disadvantages of DerSimonian & Laird method are as placing more weight on smaller studies may be dangerous if smaller studies less reliable or more prone to bias, and Danger of pretending you doesn't have to worry about heterogeneity anymore.

Network meta-analysis is a generalization of pairwise meta-analysis that compares all pairs of treatments within a number of treatments for the same condition. The graph-theoretical method for analysis of network meta-analyses uses graph-

theoretical methods that were originally developed in electrical network theory. It has been found to be equivalent to the frequenters approach to network meta-analysis [15].

Proportion of total variability attributed to between-study heterogeneity (I^2). Quantifies amount of heterogeneity as

$$I^2 = \frac{Q-(k-1)}{Q} \times 100\% \quad (8)$$

k = number of studies (k-1 = degrees of freedom)

I^2 is set to zero if Q<k-1

Meta-analysis combines the results of a number of studies. The meta-analysis would be applied with R 3.1.1 and STATA 13 computer software in this study.

D. Outcome Measures

The outcomes of health education measured in these 19 theses were patients' knowledge, as indicated on researcher-developed achievement tests at the end of the program. A meta-analysis was performed to synthesize existing research comparing the effects of information technology application and traditional instruction on students' learning achievement in Taiwan. For statistical analysis, outcomes from a variety of different studies with a variety of different instruments had to be expressed on a common scale. The transformation used for this purpose was the one recommended by Higgins, Thompson, Deeks, and Altman [10]. For reduce measurements to a common scale, each outcome was coded as a standardized mean difference (SMD) that was information technology application group's learning outcome (treatment group) minus traditional instruction group's the learning outcome (control group).

First suppose that the objective of a study is to compare two groups, such as Treated (referenced as t) and Control (referenced as c), in terms of their means. Let μ_T and μ_C be the true (population) means of the two groups. The population mean difference is defined as

$$MD_i = m_{ti} - m_{ci} \quad (9)$$

and the standardized mean difference

$$SE(MD_i) = \sqrt{\frac{SD_{ti}^2}{n_{ti}} + \frac{SD_{ci}^2}{n_{ci}}} \quad (10)$$

which is usually used as the effect size as weighted mean difference (WMD).

This study applied the effect size as standardized mean difference (SMD) with Hedges' g. Hedges' g is an extension of Cohen's d [15]. It applied with a small adjustment to give better estimates with smaller sample size. If N_i is large then adjustment is relatively small and there is little difference between the two method.

The effect size (mean difference) of Hedges' g [15] as

$$g_i = \frac{m_{ti} - m_{ci}}{S_i} \times (1 - \frac{3}{4N_i - 9}) \quad (11)$$

standard error Hedges' g as

$$SE(g_i) = \sqrt{\frac{N_i}{n_{ti}n_{ci}} + \frac{g_i^2}{2(N_i - 3.94)}} \quad (12)$$

E. Coder Reliability

For get more reliable outcomes from coding, three research assistants coded these studies (theses). Each of the three research assistants coded one third of the studies on each of the independent variables. To check for accuracy, the researcher coded each of the studies independently. In addition, the different codes on each of the studies between research assistants were discussed. The final agreement had to be met after discussion.

III. RESULTS

These studies considered for application in meta-analysis got from Taiwan Theses and Dissertations Knowledge Value-Added System, and 36 theses were obtained through this search method. The summarize of these 36 theses in this study was as Table I. They all were published after 1999. Most of them with the sample size between 51 and 100 (68.42%).

36 theses with the effect of information technology application versus traditional instruction in patients' knowledge in Taiwan were in this study. They were Li [16], Shih [17], Chao [18], Min [19], Liao [20], Su [21], Chen [22], Lu [23], Shen [24], Hu [25], Chen [26], Tseng [27], Lee [28], Lin [29], Lin [30], Fan [31], and Chen [32]. 2 studies compare the effects of leaflet therapy with group-interactive therapy. They were Shi [33] and Pan [34]. 5 studies compare the effects of leaflet therapy with interactive-technology therapy. They were Chen [35], Chiu [36], Cheng [37], Chiang [38], and Hsieh [39]. 3 studies compare the effects of leaflet therapy with multimedia therapy. They were Li [40], Chiang [41], and Wang [42]. 8 studies compare the effects of leaflet therapy with video therapy. They were Shih [43], Wu [44], Huang [45], Chung [46], Hung [47], Li [48], Chang [49], and Liu [50]. 1 studys compare the effects of video therapy with group-interactive therapy. It is Hsu's study [51]. The network of the comparisons for the network meta-analysis was as Figure 2.

There were 36 studies that discussion the effects of new therapy on preoperative knowledge of patients. They were Li [16], Shih [17], Chao [18], Min [19], Liao [20], Su [21], Chen [22], Lu [23], Shen [24], Hu [25], Chen [26], Tseng [27], Lee [28], Lin [29], Lin [30], Fan [31], Chen [32], Shi [33], Pan [34], Chen [35], Chiu [36], Cheng [37], Chiang [38], Hsieh [39], Li [40], Chiang [41], Wang [42], Shih [43], Wu [44], Huang [45], Chung [46], Hung [47], Li [48], Chang [49], Liu [50], and Hsu [51].

TABLE I. SUMMARIZE OF THESE 36 THESES IN THIS STUDY

Variables		N	%
Year of publication	2003	7	19.44
	2004	4	11.11
	2005	3	8.33
	2006	5	13.89
	2007	2	5.56
	2008	3	8.33
	2009	4	11.11
	2011	6	16.67
	2012	1	2.78
	2013	1	2.78
Treatment	No_measures vs Leaflet	17	47.22
	Leaflet vs Group_interactive	2	5.56
	Leaflet vs Interactive_technology	5	13.89
	Leaflet vs Multimedia	3	8.33
	Leaflet vs Video	8	22.22
	Video vs Group_interactive	1	2.78
Size	1-50	3	15.79
	51-100	21	68.42
	101-150	9	10.53
	151-	2	5.26
Total		36	100.00

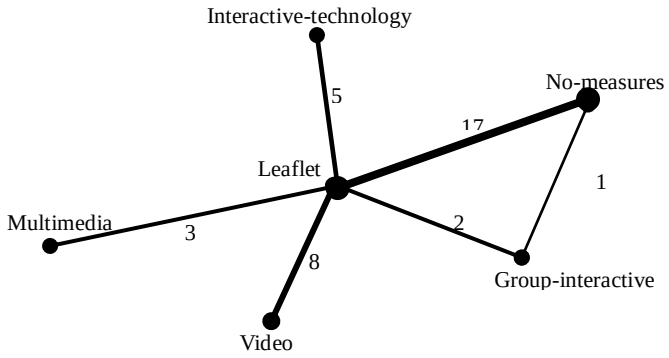

Figure 1. Network of the comparisons for the network meta-analysis.

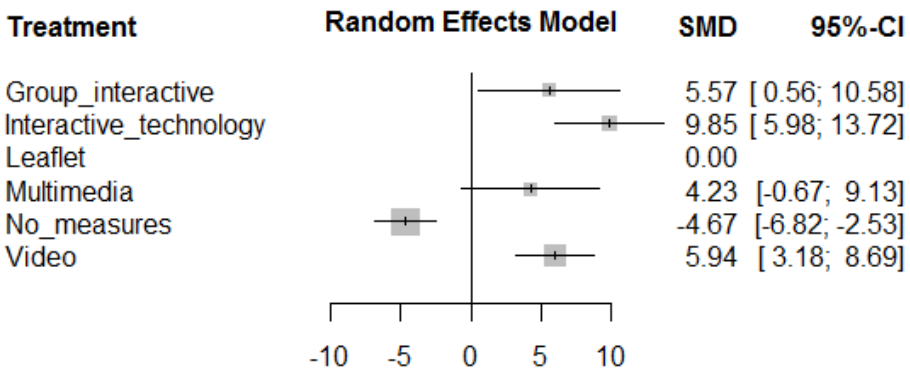

Figure 2. The network meta-analysis forest plot of the therapy of interactive-technology, multimedia, video, leaflet, and group-interactive.

The result of network meta-analysis that base on tradition health education plan was as Figure 2. The $\tau 2$ is 18.52, the I2 is 98.60%, and Q is 2269.83 (p-value<0.01). It could find that the effects of user interactive therapy was better than others (SMD=9.85), and video therapy was the second one (SMD=5.94).

IV. DISCUSSION AND CONCLUSION

The results of this study indicate that information technology application (interactive-technology, multimedia, and video) in health education plan had moderately effects on patients' knowledge over traditional health education plan (leaflet therapy) in Taiwan. The results from this study suggest information technology application on health education is positive with patients' knowledge. This study compared the effects of traditional health education plan (leaflet therapy) on preoperative knowledge of patients with the therapy of interactive-technology, multimedia, video, group-interactive, and no-measures. It could find that the effects of interactive-technology therapy were better than others, and video therapy was the second. Although traditional health education plan (leaflet therapy) that provided by nurse make some patients feel not comfortable than information technology health education plan that provided by computer. But information technology was a good tool for reduce patients' knowledge.

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REFERENCES

[1] Lewis, D., Eysenbach, G., Kukafka, R., Stavri, P. Z., & Jimison, H. "Consumer health informatics: informing consumers and improving health care," New York, NY: Springer-Verlag, pp. 239-247, 2005.

[2] Boberg, E.W., Gustafson, D.H., Hawkins, R.P., Chan, C. L., Bricker, E., Pingree, S., & Berhe, H. "Development, acceptance, and use patterns of a computer-based education and social support system for people living with AIDS HIV infection," Computers in Human Behavior, vol. 11(2), pp. 289-311, 1995.

[3] Kaufman, D. R., Patel, V. L., Hilliman, C., Morin, P. C., Pevzner, J., Weinstock, R. S., Goland, R., Shea, S., & Starren, J. "Usability in the real world: assessing medical information technologies in patients' homes," Journal of Biomedical Informatics, vol. 36(1-2), pp. 45-60, 2003.

[4] Stoop, A.P., Van't Riet, A., & Berg, M. "Using information technology for patient education: Realizing surplus value?" Patient Education and Counseling, vol. 54(2), pp. 187-195, 2004.

[5] Liddy. C., Dusseault. J. J., Dahrouge, S., Hogg, W., Lemelin, J., & Humber, J. "Tele homecare for patients with multiple chronic illnesses: Pilot study," Canadian Family Physician, vol. 54(1), pp. 58-65, 2008.

[6] Karsh, B. "Beyond usability: designing effective technology implementation systems to promote patient safety," Qual Saf Health Care, vol. 13(5), pp. 388-394, 2004.

[7] Davis, F. D. "Perceived usefulness, perceived ease of use, and user acceptance of information technology," MIS Quarterly, vol. 13(3), pp. 319-340, 1989.

[8] Chau, P. Y. K. & Hu, P. J. "Examining a model of information technology acceptance by individual professionals: an exploratory study," Journal of Management Information Systems, vol. 18(4), pp. 191-229, 2002.

[9] [9] Hannafin, M., Hannafin, K., Hooper, S., Rieber, L., & Kini, A. Research on and research with emerging technologies. In D. H. Jonassen (Ed.), Handbook of research for educational communications and technology. New York: Simon & Schuster, Macmillan, 1996.

[10] Higgins, J.P.T., Thompson, S.G., Deeks, J.J., & Altman, D.G. "Measuring inconsistency in meta-analyses," Education and debate, vol. 5, pp. 557-560, 2009.

[11] Taiwanese National Central Library. "System Introduction," Taiwan Theses and Dissertations Knowledge Value-Added System. Retrieved February 1, 2014 from http://ndltd.ncl.edu.tw/cgi-bin/gs32/gsweb.cgi/ccd=t6rqPG/aboutnclcdr.

[12] Glass, G. V. "Primary, secondary, and meta-analysis of research," Educational Researcher, vol. 5(10), pp. 3-8, 1976.

[13] Cooper H, Hedges LV, Valentine JC (2009), The Handbook of Research Synthesis and Meta-Analysis, 2nd Edition. New York: Russell Sage Foundation.

[14] DerSimonian, R. & Laird, N. "Meta-analysis in clinical trials," Controlled Clinical Trials, vol. 7, pp. 177–188, 1986.

[15] Rücker. G. "Network meta-analysis, electrical networks and graph theory," Research Synthesis Methods, 3, pp. 312–324, 2012.

[16] Li, I. J. "The effect of home care supervision on the knowledge and anxiety of mothers with very low birth weight babies who have complications," Master's Theses of National Taiwan University, Institute of Nursing, 2003.

[17] Shih, S. M. "Evaluating the effects of a pre-anesthesia education program for spinal surgery patients with general anesthesia," Master's Theses of Taipei Medical University, Institute of Nursing, 2004.

[18] Chao, Y. T. "Effects of video-based antenatal education for planned cesarean birth," Master's Theses of National Defense Medical Center, School of nursing, 2003.

[19] Min, C. N. "Influence of anxiety level of maternal newborn hearing screening for the first time, knowledge, beliefs did not pass health education guidance," Master's Theses of National Taiwan Normal University, Institute of Health Education, 2003.

[20] Liao, M. L. "An intervention study of oral health education for senior school children in elemetary schoolof kaohsiung county," Master's Theses of Kaohsiung Medical University, Oral Health Sciences Master Program, 2004.

[21] Su, R. L. "Intervention study of oral health education on knowledge and behavior for aboriginal junior high school students," Master's Theses of Kaohsiung Medical University, Oral Health Sciences Master Program, 2004.

[22] Chen, Y. L. "Evaluation of a educational program on foot-care knowledge, self-efficacy and practice for aborigine with type 2 diabetes in the mountain village of hualien county," Master's Theses of Tzu Chi University, Aboriginal Health Institute, 2005.

[23] Lu, S. F. "Impact of an aids education program on knowledge and attitudes of elementary 6th graders," Master's Theses of Asian University, Institute of Health Management, 2008.

[24] Shen, H. C. "Evaluation of a fall prevention education intervention for elderly inpatients in taipei county hospital," Master's Theses of National Taiwan Normal University, Department of Health Promotion and Health Education, 2009.

[25] Hu, C. W. "Integrated care plan on the effectiveness of self-care of chronic kidney disease patients quality of life," Master's Theses of HungKuang University, Department of nursing, 2009.

[26] Chen, C. L. "Effects of a school-based hiv/aids education program among grade 10 night school students in Taoyuan county, Taiwan," Master's Theses of Fu Jen Catholic University Department of Public Health, 2009.

[27] Tseng, P. L. "A hearing protection program for undergraduates' knowledge, attitudes, and intended behaviors towards the prevention of noise-induced hearing loss," Master's Theses of National Taiwan

Normal University, Department of Health Promotion and Health Education, 2009.

[28] Lee, H. J. "The effects of health education programs on weight management for day care unit patients with mental disorders," Master's Theses of Central Taiwan University of Science and Technology, Department of nursing, 2011.

[29] Lin, S. C. "Effects of discharge planning on the knowledge, competence, and maternal confidence of the mother with preterm infant," Master's Theses of National Taipei University of Nursing and Health Sciences, Department of nursing, 2011.

[30] Lin, Y. C. "Impact of individual pre-operative patient education on oral cancer patients' operative anxiety status and knowledge level following microscopic flap reconstruction surgery," Master's Theses of National Yang-Ming University, Institute for Clinical and Community Care, 2011.

[31] Fan, H. Y. "The effectiveness of life skills education program in diabetic patients," Master's Theses of Central Taiwan University of Science and Technology, Department of nursing, 2011.

[32] Chen, H. H. "Effect of a metabolic syndrome prevention program on knowledge attittude, and behavior towards diet and exercise and anthropometry in community-dwelling elderly," Master's Theses of Fu Jen Catholic University, Department of Nutritional Sciences, 2012.

[33] [33] Shi, Q. H. "Experimental study of parents of children with asthma care knowledge and skills related to physical activity intervention," Master's Theses of National Taiwan Normal University, Institute of Health Education.

[34] Pan, J. G. "Effect of resistance training education on exercise knowledge, behavior and physiological indicators in type 2 diabetic patients," Master's Theses of Tzu Chi University, Department of nursing, 2006.

[35] Chen, Y. S. "The effect of a prenatal web-based newborn care education on mother's newborn care knowledge, and maternal confidence," Master's Theses of National Taipei University of Nursing and Health Sciences, Department of nursing, 2005.

[36] Chiu, Y. T. "Studying effects of web-based, integrated patient education system on diabetic patients' medication adherence," Master's Theses of Taipei Medical University, Graduate Institute of Biomedical Informatics, 2006.

[37] Cheng, H. Y. "Effect of multimedia nursing intervention on self-care agency, nutrition and quality of life on peritoneal dialysis patients," Master's Theses of Fooyin University, Department of nursing, 2007.

[38] Chiang, C. L. "Effectiveness of multimedia nursing education on self-care ability, pressure garment application knowledge, and quality of life of burn patients with scar contracture," Master's Theses of I-Shou Universit, Executive Master Degree of Business Administration, 2011.

[39] Hsieh, H. W. "The effects of the multimedia videodisc health teaching via pamphlet on neonate care of new immigrant mothers," Master's Theses of HungKuang University, Department of nursing, 2011.

[40] Li, Z. T. "Postpartum sexual health education model development and intervention effectiveness research," Master's Theses of National Taiwan Normal University, Institute of Health Education, 2003.

[41] Chiang, H. H. "Effect of multimedia nursing intervention on the knowledge, attitude, behavior intention and behavior of patients with chronic renal insufficiency," Master's Theses of National Defense Medical Center, School of nursing, 2004.

[42] Wang, M. F. "Health education on hepatitis c: the development and evaluation of a multimedia-based program," Master's Theses of National Taipei University of Nursing and Health Sciences, Department of nursing, 2005.

[43] Shih, H. C. "Effects of video-based Lamaze method on maternal labor knowledge, attitudes, practice, and controlling of labor pain," Master's Theses of National Defense Medical Center, School of nursing, 2003.

[44] Wu, H. L. "The compresion with health education vcd and leaflet for coronary artery disease patient's diet cognition and self-efficacy," Master's Theses of Tzu Chi University, Department of nursing, 2004.

[45] Huang, J. P. "Effects of multimedia-based education in traditional Chinese medicine with western nursing for diabetes patients western nursing for diabetes patients," Master's Theses of National Taipei University of Nursing and Health Sciences, Institue of Integration of Traditional Chinese Medicine with Western Nursing, 2006.

[46] Chung, Y. C. "Effectiveness of multimedia interactive nursing intervention on decision making, uncertainty and quality of life of patients with end-stage renal disease," Master's Theses of Fooyin University, Department of nursing, 2006.

[47] Hung, T. P. "Effects of video-based education on the contraceptive knowledge, attitude, and behavior of the perused Vietnam woman - the beitou and wanhua district, Taipei city," Master's Theses of National Defense Medical Center, School of nursing, 2007.

[48] Li, H. P. "The effectiveness of using multimedia teaching in wound dressing change for post-operative patients on knowledge, self-efficacy and level of anxiety," Master's Theses of Fooyin University, Department of nursing, 2008.

[49] Chang, S. F. "Effect of two kinds of health education for circumcision on mother's knowledge, anxiety, days for follow-up ,and nursing teaching time," Master's Theses of Kaohsiung Medical University, Department of nursing, 2008.

[50] Liu, S. J. "The effect of video - based nursing instruction on mothers' anxiety and related knowledge before pediatric cardiac surgery," Master's Theses of Central Taiwan University of Science and Technology, Department of nursing, 2013.

[51] Hsu, H. C. "The effect of group psych education program with multiple strategies for depressed patients," Master's Theses of National Cheng Kung University, Department of nursing, 2006.