Development and Effectiveness of Web Based Learning Nursing Process Program on Linked NANDA, NOC and NIC

Hwa Sun Kim¹ and Hong Sung Jung²

¹Faculty of Medical Industry Convergence, Daegu Haany University, Gyungsan 38610, South Korea, pulala@dhu.ac.kr
²Department of Nuring, Semyung University, Jechon 27136, South Korea.ag39272naver.com

Abstract

This study was done to develop and evaluate comprehensive web based learning program for improving learning ability in the nursing process of nursing students. We evaluated the contents based on the sufficient teaching materials and developed the process for implementation of the educational system. The study was focused on developing guidelines applicable to any clinical situation using a framework of links among all nursing diagnoses, outcomes, and interventions. This study was used a descriptive study and the participants were 62 nursing students. There were significant differences of achievement of learning objectives, application to work, according to the frequency of program use. Therefore, this results indicate that the web based learning nursing process program is effective in improving will help to strengthen learning calculation ability of nursing students in nursing process. Further study should be done develop additional program for improving application.

Keywords: Nursing Process, Guideline, Classification, Education

1. Introduction

As a result of the continued development of medical technology and improvements in the level of knowledge regarding medical subjects, continuous quality improvement in nursing is essential in the rapidly changing competitive medical environment. Also, accurate and prompt delivery of information and the appropriate use of information are necessary, given the ever-increasing amount of information. Improved productivity with regard to medical records and other areas of nursing management are also important in improving the quality of nursing [1].

Typically, at a medical institution, the nurse has the most information. In the course of nursing, the nurse should select important patient-related information and use it in the direction of patient care and in overall nursing management. However, efficient storage and use of patient-related information are not usually skills in which nurses are trained or for which they are evaluated, and meaningful patient data that are not recorded immediately can be lost in some cases.

Most information created and used by the nurse conventionally takes the form of natural language. As EMR systems have developed, a common question is how best to record information to accurately reflect the phenomena of nursing and the problems of patients. The use of natural language in an EMR system is optional, but if all clinical information used by nurses is stored in a natural language state alone, it is not readily accessible to computer-based applications, such as, for example, statistical research or automated decision-making systems [2-3]. Nursing professionals have typically pursued specialized training and nursing education has undergone change in the last decade with

the introduction of information technology [4]. Nursing diagnosis not only demonstrates that the essence of nursing is the underlying science, facilitating the development of theories and nursing studies [5]. But, undergraduate nursing students considered clinical practice to be the most stressful in nursing program education.

Therefore, the purpose of this study was to develop and evaluate the comprehensive web based program for improving learning ability in the nursing process of nursing students. Through this research, we can effectively not only apply the nursing process but also develop learning ability in clinical practice education.

2. Method

2.1. Research Design

This study was used a descriptive study for the web based nursing program by nursing students during clinical nursing practice education.

2.2. Participants

Study participants were eligible nursing students in C province of South Korea and 62 nursing students were willing to participate in this study from April and December, 2014.

3. Instruments

3.1. Web Based Nursing Program

Johnson *et al* [6] described the linkage of NANDA, NOC, and NIC, and this nursingterminology system (NNN) can be used as the language of nursing courses. However, each linkage was based on the determination of specialists, rather than the results of statistical analyses of the actual behavior of nurses.

3.2. Developmental Environment

The development and operational environment of system is as follows.

- Program language: Java (development kits 1.8.0)
- User Interface: Java Swing
- Database: MySQL Server 5.6
- Database Interface: JDBC (MySQL connector 5.1.27)
- Operating System: Windows 2003 server

The basic development language of system was Java language. Therefore, in order to access DBMS (Database Management System), JDBC (Java Database Connectivity) offered by Microsoft was used. Also, the saving, search, modification, and deletion of data were performed using DAO (Database Access Object). Data in system was generated and delivered in the pattern of a Java class, and this was nominated simply as 'Bean'. Also, this system was performed based on the service-oriented architecture (SOA), which assembles the defined service according to business requirements and realizes desired functions, unlike existing development methods [7].

3.3. Reactivity of Program and Achievement of Learning

To evaluate reactions to the program, utilizing frequency and correction answer rates were calculated based on the average times daily who participated, number of times recorded programs were accessed on the administrator screen for 8 weeks. In order to evaluate satisfaction with the program, we used five items from Nguyen's Satisfaction Questionnaire-8 (CSQ-8) [8]. The CSQ-8 measures perceptions of actual use and satisfaction with utilization and includes the following items: "How would you rate the quality of the education you used? Did you receive the program you expected? How much does this program satisfy the nursing process using you expected? Would you recommend this program to your friends? How would you rate your overall satisfaction with the program you used? Do you think web based nursing process education program is necessary?" Each item was measured on a 5-point Likert scale, with high scores indicating high satisfaction.

3.4. Benefits to Work

To evaluate benefits to the program, confidence and anxiety level were measured for applying in nursing process. Confidence and anxiety levels were measured using a NRS (numeric rating scale).

4. Data Analysis

Data were analyzed using the SPSS WIN (22.0). Descriptive statistics, appropriate the level of measurement, were used to describe the study variables. Paired-t tests and one way ANOVA were used to assess the mean differences among groups.

5. Results

5.1. System Design

Two experts analyzed the structure and requirements of the program to develop useful program in the learning of nursing process. As a result of analysis, the structure of the program consists of the client program through the query processing and the NNN database web server. The client program consists of four functions, patient information, nursing plan, nursing practice, of nursing record (Figure 1). In particular, the NNN database server built up the relational database by analyzing the data in an object-oriented perspective.



Figure 1. Architecture of Web Based Nursing Process Program

5.2. System Development

This study developed Nursing Process Program to meet the analyzed requirements by using the Java programming language. This program used NNN JDBC MySQL connector to connect to the database server built into MySQL Server 5.6. And the program is implemented the user interface by using Java Swing. The user can join the member registration in screen, when approved by the administrator may execute the program. The

program is composed of the registered patient information, nursing plan, nursing practice, nursing record tab. Registered patient is updated the left panel at the same time (Figure 2).

User Name		성춘향	Patient Information	Nursing Information	Nursing Plan	Nursing Pract	ice Nursing Rec	ord		
Affiliation		DO대학교		Number			Name		Age	[
Group	Se	myung Univ.		Gender	Male	Eemale	Admission Date		1	
Name 💌				Creator	A	8 <i>7</i> 1	Blannor	[Bracticonor	[
Condition	Reset	Search		Chief Complaint	<u> </u>	18				
Creator	Planner	Practicener		Ciner Complaint						
Name Gender	Age	Admission Date								
홍길동 M	26	2015/09/14								
				Family Hx						
				Past Hx						
				Diagnosis1					Set	Clear
				Diagnosis2					Set	Clear
				Diagnosis3					Set	Clear
				Diagnosis4					Set	Clear
				Diagnosis5					Set	Clear
				Remark						
									7	
				Operation1					Set	Clear
				Operation2					Set	Clear
				Operation3					Set	Clear
				Operation4					Set	Clear
				Operation5					Set	Clear
Cleator				Remark						
Planner										
Practicener										
Diagnosis		Ψ.								
Operation				Create	Modify					

Figure 2. Patient Information

The nursing plan tab is activated when you select one of the registered patients, this can temporarily select and store nursing diagnosis (defining characteristics, related factors, risk factors), nursing results (indicators), intervention (Nursing activities) conjunction with 8 tables placed in the top (Figure 3 a-b).

Search Linkage						
Diagnosis		1	Related Factor	Defining Characteristic		
Imbalanced nutrition: less than body requirements	-		Decreased sweat response	Abnormal posturing	-	-
Risk for infection	=		Dehydration	Apnea		
Risk for imbalanced body temperature			High environmental temperature	Coma		
Hypothermia			Illness	Convulsions		
Hyperthermia			Inappropriate clothing	 Flushed skin 		
Ineffective thermoregulation			Increased metabolic rate	Hypotension		
Autonomic dysreflexia			Ischemia	Infant does not maintain suck	_	-
Risk for autonomic dysreflexia			Pharmaceutical agent	Irritability		
Constipation			Sepsis	Lethargy		
Perceived constipation			Trauma	Seizures		
Diarrhea			Vigorous activity	Stupor		
Bowel incontinence		IE		Tachycardia		
Risk for constipation		11		Tachypnea		-
Impaired urinary elimination		11		Vasodilation		-1

Figure 3a. Nursing Diagnosis Tables

Search		earch
Outcome	Indicator 1 2 3 4 5 Intervention	Activity
Thermoregulation	Follows recommended precautions	Maintain agency policies and procedure 🔺
Thermoregulation: Newborn	Follows recommended treatment regimen	Maintain and environment that maximize
Vital Signs	Follows prescribed activity level	Avoid interruptions when preparing, verif
	Follows medication regimen	Follow the five rights of medication admi
	Avoids behaviors that potentiate pathology	Verify the prescription or medication ord
	Performs self-care consistent with abgility 🔄 🔄 🔄 🔄 🔲 Temperature Regulation: Perio	perative Prescribe or recommend medications,
	Performs prescribed procedure Hemodynamic Regulation	Monitor for possible medication allergie
	Monitors treatment therapeutic effects	Note patient's allergies before delivery o
	Follows prescribed diet	Notify the patient of medication type, rea
	Monitors treatment side effects	Ensure that hypnotics, narcotics, and an
		Note expiration date on medication cont
		Prepare medications using appropriate
		Verify changes in medication form prior t
		Use bar code assisted medication adm 👻

Figure 3b. Nursing Results and Intervention Tables

5.3. Adopting Evaluation

Reactivity of program and achievement of learning objectivity

The high group students showed more number of participants (F=321.83, p<.001), connect time (F=94.77, p<.001), and satisfaction (F=29.312, p<.001) than two group (low group and middle group) students.

And the high group students had higher knowledge with nursing process (F=67.114, p<.001) than two group (low group and middle group) students (Table 1).

		Low group(n=13)	Middle group(n=22)	High group(n=27)	F(<i>p</i>)
Reactivity	Number of participants	11.21(21.21)	17.21(15.90)	90.12(31.21)	321.83(<.001)
	Connect time(min)	30.01(15.21)	48.21(26.33)	230.33(142.21)	94.77(<.001)
	Satisfaction	3.09(.70)	3.81(.59)	4.59(.50)	29.312(<.001)
Achievement	Nursing process knowledge	5.18(.98)	6.45(1.43)	9.03(.59)	67.114(<.001)

Table 1. Reactivity of Program and Achievement of Learning Objectivity

Benefits to work (confidence, anxiety level) according to the degree of use of the program.

There was significant difference in confidence, and anxiety level the degree of use of the program among groups (Figure 4).



Figure 4. Benefits to Work (Confidence, Anxiety Level) According to the Degree of Use of the Program

5. Discussion

Element of an autonomous profession is the existence of a clearly defined body of background knowledge. In nursing, it should be possible to present data about nursing tasks with respect to what a nurse should do, how the nurse differs from other professionals, and how the nurse contributes to the health of patients. Such information facilitates the development of middle-level theories that provide useful knowledge in clinical decision making, based on research and practice [9].

NANDA is the most suitable and commonly used classification scheme for describing the patient's problem, and it continues to contribute to the accumulation of the body of nursing knowledge. NIC, developed at the University of Iowa, is a standardized classification system of interventions performed by a nurse and is useful in various aspects of nursing, such as clinical records, communication between clinical sites, integration of data that transcend the field or system, effective research, measurement of productivity, evaluation of abilities and compensation, and the design of nursing curricula [10]. NOC, also developed at the University of Iowa, is a classification system developed to assess patient outcomes as affected by nursing. A nursing outcome represents solutions to a nursing diagnosis; it is more detailed than a diagnosis and provides guidelines for the proper selection of actions that are expected to be carried out. Additionally, an indicator of nursing outcomes can be used for the development of a clinical path or an individual nursing plan [11]. The nursing process is typically explained in five stages: assessment, diagnosis, plan, intervention, and evaluation. When providing a nursing diagnosis, however, the nurse assesses factors related to signs and symptoms of the subject and

establishes a desirable response to the problem, identified as the expected nursing outcome. The nurse further plans and carries out the nursing intervention that removes or reduces related factors identified in the nursing diagnosis. Accordingly, the NNN linkage of nursing diagnoses, outcomes, and interventions is clinically valuable because it is closely correlated with the nursing process and can be regarded as a summary of the nursing process. Despite the usefulness of the nursing process and demands for its use, expansion in its clinical application has been slight. One reason for this is that applying the nursing process requires a lot of record keeping time in the clinical situation, and the thought process for arriving at nursing diagnoses is difficult, making it also difficult to determine nursing diagnoses and interventions quickly. Other causes include lack of selfconfidence as to whether a nursing diagnosis made through such a difficult thought process is truly appropriate. The nursing information system is the same computer system that manages standardized patient information required for nursing. It enables the collection, use, storage, searching, and exchanging and communicating of information required for connecting nursing research and education to nursing practice [12]. The information system for the nursing process is important for improving the quality of nursing and for establishing nursing professionalism.

However, several limitations have been identified in attempts to computerize the nursing process in Korea. First, it is difficult to expect improvements in nursing through computerization if the system is used by a nurse not familiar with the nursing process, if there is a failure to build a standardized database, or if the database contains inaccurate data. Furthermore, it is difficult to maintain consistency and continuity of nursing if the classification system used is not of proven validity.

The linkage of nursing diagnoses, outcomes, and interventions developed by [6] and argued that the nursing intervention for the expected nursing outcome begins with the nursing diagnosis. However, their linkage system was achieved using recommendations of professionals alone. It did not assess outcome or intentions by statistical analyses of the actual behaviors of nurses. Accordingly, outcomes after application of the linkage system were not presented, and evaluations of the system by nurses have not yet been conducted. In Korea, although some studies have developed nursing process computerized programs and integrated them with nursing information systems [13-15] there are few studies regarding the results of such efforts in actual clinical settings. Systems developed as a result of such research can provide nursing diagnoses, identify features and related factors in the patient, show nursing intervention activities corresponding to the diagnosis, and show the expected nursing outcomes. However, the personal knowledge and experience of the nurse are most critical in providing nursing diagnoses and interventions in this system. Accordingly, inexperienced nurses still consider it difficult to apply the nursing process in the clinical situation. Additionally, while systems developed in previous studies used systems of standardized terms for nursing diagnoses, outcomes, and interventions, they did not contain actual data or nursing statements used in clinical situations, although some adopted nursing-activity statements, creating the additional inconvenience of double records.

6. Conclusion

This study was focused on integrating a nursing knowledge system using web based programs to enhance the applicability of the nursing process to clinical practice. This was done by including actual data and nursing statements corresponding to the signs and symptoms of subjects to the nursing information system with the aim of helping the nurse to easily identify the patient's problem. Additionally, in this study, a goal was to construct a nursing information system using linkages among nursing diagnoses, outcomes, and interventions. This system is intended to assist nurses in readily establishing more accurate nursing diagnoses, thereby helping them to determine the priority of nursing interventions and providing measures for those interventions. Such a process would contribute to improving nursing practice and establishing a body of professional knowledge. The significance of this study can be explored from the points of view its theoretical, practical, and educational aspects. First, in theoretical aspect, this report describes practical nursing phenomena by studying and comparing a nursing diagnosis / outcome / intervention linkage constructed as a result of this study in various nursing units, and obtaining practical nursing knowledge, resulting in the facilitation of middlelevel theory development based on nursing practice. Secondly, in practical aspect, the nursing information system based on the nursing diagnosis / outcome / intervention linkage constructed as a result of this study supports the decision making of nurses. It will allow them to provide more accurate nursing diagnoses based on professional thinking and to develop nursing outcomes and interventions according to these diagnoses, resulting in improved nursing quality and efficiency. Additionally, the system describes the effects of nursing practice and can be used as basic data for calculating nursing expenses. Third, in educational aspect, using the system described, standards can be developed for each type of nursing unit based on a nursing information system that includes a nursing diagnosis / outcome / intervention linkage, and this can be used in nurse education.

Acknowledgment

These should be brief and placed at the end of the text before the references.

References

- [1] M. S. Fetter, "Interoperability--making information systems work together", Issues in Mental Health Nursing., vol. 30, (2009), pp. 470-472.
- [2] J. Klehr, J. Hafner, L. M. Spelz, S. Steen and K. Weaver, "Implementation of standardized nomenclature in the electronic medical record", International Journal of Nursing Terminologies & Classifications, vol. 20, no. 4, (2009), pp. 169-180.
- [3] N. Mitchell, R. Randell, R. Foster, D. Dowding, V. Lattimer and C. Thompson, "A national survey of computerized decision support systems available to nurses in England", Journal of Nursing Management., vol. 17, (2009), pp. 772-780.
- [4] L. Boyer, J. Tardif and H. Lefebvre, "From a Medical Problem to a Health Experience: How Nursing Students Think in Clinical Situations", Journal of Nursing Education, vol. 54, (**2015**), pp. 652-632.
- [5] G. Keenan and M. L. Aquilino, "Standardized nomenclatures: keys to continuity of care, nursing accountability and nursing effectiveness", Outcomes Management for Nursing Practice., vol. 2, no. 2, (1998), pp. 81-86.
- [6] M. Johnson, G. Bluechek, H. Butcher, J. M. Dochterma, M. Maas and S. Moorhead, "NOC and NIC Linkages to NANDA-I and Clinical Conditions: Supporting Critical Reasoning and Quality Care", NANDA, NOC, and NIC Linkages, St. Louis, MO: Mosby,(2011).
- [7] A. Bucur, R. Kootstra, J. V. Leeuwen and H. Obbink, "Service-oriented architecture for grid-enabling medical applications", Studies in Health Technology and Informatics., vol. 120, (**2006**), pp. 55-68.
- [8] T. D. Nguyen, C. C. Attkisson and B. L. Stegner, "Assessment of patient satisfaction".
- [9] M. A. Blegan and T. T. Reimer, "Implication of nursing taxonomies for middle-range theory development", Advances in Nursing Science., vol. 19, no. 3, (**1997**), pp. 37-49.
- [10] J. M. Dochterman and G. M. Bulechek, "Nursing interventions classification (NIC)", St Louis, MO: Mosby, (2004).
- [11] S. Moorhead and M. Johnson, "Diagnostic-specific outcomes and nursing effectiveness research", International Journal of Nursing Terminologies & Classifications, vol. 15, no. 2, (2004), pp. 49-57.
- [12] J. Manning and E. A. McConnell, "Technology assessment: a framework for generation questions useful in evaluation nursing information systems", Computers in Nursing, vol. 15, no. 3, (**1997**), pp. 141-146.
- [13] Y. H. Yom, J. E. Kim, B. C. Chun, S. Choi, D. H. Whang and K. M. Park, "Development of standardized and competency-based curriculum in nursing informatics", Journal of Korean Society Medical Informatics, vol. 13, (2007), pp. 227-236.
- [14] M. K. Jee and S. A. Chi, "Linkages of nursing diagnosis, nursing intervention and nursing outcome classification of breast cancer patients using nursing database", Journal of Korean Academy of Nursing Administration, vol. 9, (2003), pp. 651-661.
- [15] E. J. Lee and H. J. Park, "Development of nursing process program using the linkages of NANDA-NOC-NIC", Journal of Korean Society Medical Informatics, vol. 9, no. 1, (2003), pp. 107.

Authors



Hwa Sun Kim, Ph.D. is a professor of the Faculty of Medical Industry Convergence at Daegu Haany University. She is a RN and has the Ph.D. degree in Medical Informatics from Kyungpook National University. Hers research interests are mobile healthcare, hospital information system, and standard terminology.



Sung Jung Hong, Ph.D. is a professor of the Department of Nursing at Semyung University. She is a RN and has the Ph.D. degree in Nursing from Kyungpook National University. Hers research interests are nursing education, health behavior for vulnerable population, and evidence-based practice.