Development of Nursing Informatics Education Model for Strengthening Information Processing Capability

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Abstract: This study aimed to develop education model based on Tyler's four-step curriculum theory to enhance the ability of nursing information processing. The subjects of this study were 37 students of undergraduate nursing science course at the university from September, 1, 2014 to December, 11, 2014. Before class begins, the team work skills were assessed, the reevaluation was made at the end of the class and then data were analyzed using descriptive statistics. Developed curriculum and non-curriculum liking integrated education model to enhance the nursing information processing capability, according to Tylor's curriculum development and operation procedures. Curriculum course work included the liberal art course (Excel, Word, etc.) and nursing major course which is the title of nursing informatics. Non-curriculum activity included club activity named NISR (Nursing Information and Statistics Research), special lectures about nursing statistics and mobile application development. After the course work, I checked the 3 learning outcomes (the level of information theory and knowledge, mobile application template development ability and data analysis ability. Analysis of academic achievement degree of learning performance based on the above evaluation criteria. Among the 37 students, learning outcome 1 and 2 were found to be more than 'middle' but in the case of learning outcome 3-5 students (13.5%) were 'low'. Student's teamwork skills after the 1st and 15th lectures of the lectures, the post-test score (3.94, 0.45) was higher than the pre-test score (3.89, 0.39). Curriculum and non-curriculum linkage integrated education model was found to be effective. This study proposes to develop a competency-based curriculum linkage model in accordance with the characteristics of the curriculum.

Key words: Nursing students, information processing ability, curriculum and non-curriculum linkage integrated education model, nursing informatics, education model development

INTRODUCTION

In the era of the fourth industrial revolution, the ability to manage and utilize the medical information that is sky rocketing has become important for medical practitioners. Especially, clinical decision support for medical diagnosis and treatment using medical big data analysis accumulated by development of self learning algorithm such as artificial neural network is becoming active. As the ability of nurses to collect, store, process and utilize medical and nursing information is required in the clinical field, the educational model should be changed to strengthen the ability to process nursing information through the experience in the university curriculum. The experience-based curriculum proposed by Bobbit and Dewey shows that the learning outcomes depend on the learner's practical experience through the learning process. Therefore, in order to develop specific competencies, learning process is significant. In order to cultivate the talented needed in modern society and to develop the required competencies, this study

emphasized the importance of practical inquiry, not merely transferring and memorizing knowledge and proposed competency-based curriculum as an alternative (Ko et al., 2013; Jihyun et al., 2015; Kim, 2014; Kim and Lee, 2013).

In the 21st century, along with the advent of a knowledge-driven society, the perception that human resources is the key driver of national development and that individual capacity building is of the utmost importance has been heightened. Competency is the cornerstone and guideline of the education plan. All elements of curriculum operation such as organization of teaching content, organization, teaching-learning methodology and evaluation process as well as teaching-learning goal setting are carried out based on competency. Therefore, it is necessary to identify the operation as efficient as possible in consideration of this competency basis (Kim and Lee, 2012; Min and Kim, 2012).

Particularly, it is a tendency to emphasize student centered participatory learning, experiential learning and cooperative learning in order to develop the capacity of

undergraduate students. A curriculum design that links liberal arts and majors during campus life is also emerging so that students can take the lead in class and gain insight into the cause of a particular event or the complexity of the phenomenon. Min and Kim (2012) propose that the liberal arts-majors education model should be developed as institutional, parental and compromising (Lee, 2013).

Until now, most of the nursing informatics course design has been limited to the theoretical part and even though the practice has been carried out it was merely to acquire basic document writing ability such as excel program at computer lab. There is a need to cultivate more high-level and diverse range of abilities such as database management and medical information data mining by learning various software. Therefore, in order to strengthen the information processing ability of nursing students it is necessary to develop a learning model that develops information processing and utilization ability among undergraduate student's core competencies by trying various types of prior learning, experience learning and cooperation learning.

Based on Tyler's four-step curriculum development and operation procedure theory (Yi, 2002) a curriculum-comparative and interdisciplinary education model for effective curriculum design in nursing informatics curriculum was presented. The objective of this study is to develop education model for a nursing informatics that links the curriculum with the comparative course to enhance the nursing information processing capability that nursing students should possess. The specific objectives are as follows. First, develop nursing education model of curriculum and non-curriculum linkage based on Tyler's theory:

- 1st step: design learning objectives that reflect the information processing capabilities of nursing informatics courses
- 2nd step: select a learning experience (curriculum non-curriculum comparisons) to achieve your learning goals
- 3rd step: organize selected learning experiences to promote the achievement of information processing capabilities
- 4th step: evaluate learning experiences and present a curriculum-non-curriculum linked education model

Second test effectiveness of the model:
- Evaluate achievement level of 3 learning outcomes (the level of information theory and knowledge, cooperation and teamwork skill and data analysis ability)

- Test teamwork skill scores of the subjects before class and after class

MATERIALS AND METHODS

Research design: This study developed and presented a curriculum-non-curriculum linked education model developed in the process of educational process development and operation of Tyler's four-step theory based on nursing informatic's curriculum. Tyler's four-step curriculum development and operation procedures were theoretically designed a curriculum-non curriculum comparative linkage education model based on theoretical foundation of education process development and operation process.

Education model development procedure based on Tyler's theory: Tyler's curriculum development and operation procedures refer to the application of the four-factor cycle of educational objectives, selection of learning experiences, organization of learning experiences and evaluation of learning experiences as shown in Fig. 1. I create a lesson plan for curriculum activities and comparisons and activities and operate them in the following steps.

1st step; nursing informatics instructional objective design:
- Set up instructional goals that reflect the learning outcomes of the nursing informatics curriculum
- Confirmation of learning outcomes of nursing informatics and adjacent subjects

2nd step; selection of nursing nformation processing learning experience:
- Planning lecture and practice to nurture nursing information processing knowledge and skills
- Plan special lectures and self-help activities to enhance nursing information processing ability and nursing research ability
- Establish activities and support measures to improve team work skills

3rd step; organization of nursing information processing learning experience:
- Balanced placement of lectures, lectures and exercises on curriculum activities
- Supports lectures and activities on comparison and activities

4th step; Evaluation of the learning experience:
- Developed and evaluated rubrics for evaluating the achievement of 3 learning outcomes
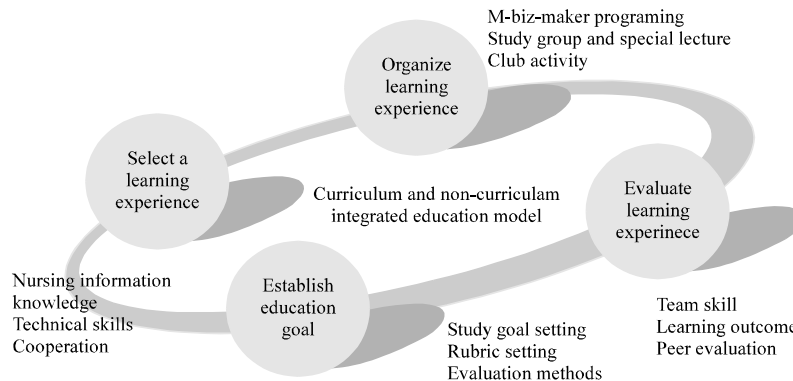
Fig. 1: Curriculum and non-curriculum linkage integrated education model of nursing informatics

Test effectiveness of model: To test the effectiveness of the education model as shown in Fig. 1. I assessed 3 learning outcome of student in class. The first learning outcome is "Acquired information knowledge" and second learning outcome is "teamwork and cooperates". The last learning outcome is "research ability". I set the performance base level and developed appraisal methods.

Subject of study: The subjects of this study were 37 students of undergraduate nursing science course at the university in city 'C' of Chungcheongnam-do and they agreed with participation and listen to the purpose and explanation of the research and signed informed consent.

Research tools: Teamwork skill evaluation tool and peer evaluation tool were used to evaluate competency achievement after class.

Teamwork skill assessment tool: In order to conduct the pre-post test of teamwork skill, I used a personal teamwork skill measurement tool developed by Yoon Woo Jae based on the research of Cannon-Bower. This tool is composed of 5 sub-domains, total 20 items including job ability (5 items), adjustment (5 items), achievement of team goal (4 items), individual sacrifice (3 items) and interpersonal relationship (3 items). Each item is measured on a 5-point scale. The higher the score, the higher the teamwork skill. Reliability was cronbach's alpha = 0.90 in the study by Yoon Woo Jae and 0.84 in this study.

Peer evaluation tools: The team members who participated in the team project were ranked according to

the ranking method for participation (aggressiveness), excellence, collaboration ability and contribution and the questionnaire developed by the researcher was used.

Data collection and analysis: The course was from September, 1, 2014 to December, 11, 2014. Before class begins, the teamwork skills were assessed, the reevaluation was made at the end of the class and then data were analyzed using descriptive statistics. Peer evaluation was conducted at the end of the lesson and data were analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Establish goal
Design learning objectives that reflect the information processing capabilities of nursing informatics courses: Teamwork skill evaluation tool and peer evaluation tool were used to evaluate competency achievement after table must be in table format. Enter the data in the table and present it as such Bloom classified educational objectives into cognitive domain, definitional domain and epistemic domain in Educational Objective Taxonomy, Synthesis and evaluation.The purpose of the understanding and application level is reasonable considering that the students who take this course are sophomore and have not yet experienced clinical nursing practice. The result of nursing achievement goal is suggested in Table 1.

Selection of nursing information processing learning experience: for the practical approach of the curriculum, the learning experience was selected according to the question presented by Schwab:

- Q1: What is the actual technology and how does it relate to the curriculum?

Table 1: Nursing achievement-information processing capability-linkage of instructional objective

Learning outcomes	Information process competence	Level of educational goal	Class goal
Level of information theory and knowledge	Apply nursing knowledge required for former nursing integrally to practice Mobile application template development ability	Comp rehension	Acquire and understand the knowledge of nursing and medical information
Level of information theory and knowledge	Mobile application template development ability	Practice	Creatively create and present nursing-related apps (team projects) using M-biz maker program
Cooperation and teamwork skill	Coordinate and co-operate within the team to solve health problems	Practice	Know the importance of collaboration and successfully complete a team project
Data analysis ability	Conduct nursing research based on scientific evidence	Practice	Plan and write mini nursing research report through nursing statistics processing

Table 2: The road map of curriculum and non-curriculum organization of activities

Curriculum

Liberal arts course	Nursing major course	Non-curriculum activities
Excel	Nursing statistics (1st semester of sophomore	Establishment of nursing informatics research study group and link club activities
Word processor during fresh and sophomore)		Special lecture on nursing (take statistics and app development activities
		Study group application and activities of the teaching and learning development institute
		M-biz maker certification acquisition activity

- Q2: What role do school curriculum specialists play in learning practical skills?
- Q3: What is the role of curriculum professors who are college curriculum experts?

In order to acquire knowledge of nursing information and integrate it into practice it can be understood that some understanding of nursing information concept and learning experience, learning experience through nursing application development activity and l earning experience for nursing research are needed.

Q1: What are the practical skills of nursing information processing skills and how are they related to the curriculum? The following learning experiences are required to acquire knowledge and understanding of the concept of nursing information:

- Knowledge of concept of nursing information through lectures
- Nursing information website navigation activities
- Understanding nursing information activities through video and multimedia materials

Q2: What do I need to learn the practical skills of nursing information processing skills? Nursing app development team to use the app development authoring tool for the project activity, you need to demonstrate teamwork so, you can consider the following learning experience:

- Establish database concept and learn how to use M-biz maker
- Activities to explore nursing topics from an informational perspective for the development of nursing apps
- Demonstrate teamwork through division and collaboration and continue to engage in app development activities

In order to cultivate nursing research ability basic knowledge on narrative statistics and inference statistics is needed and data management ability is required. Therefore, the following learning experience is require:

- Learn how to use the Excel program for data coating and management
- Learn how to use document work programs such as HWP and word for report generation
- Knowledge of research methodology for nursing research planning and implementation
- To acquire basic knowledge on descriptive statistics and inferential statistics for determining analysis methods of nursing research data
- Learn how to use statistical analysis programs such as, SPSS for nursing research data analysis

Q3: What is the role of the subject professor in improving the nursing information processing ability? As an observer, facilitator, facilitator of the learning experience you should be able to lead students to apply their knowledge to the real world through team project activities. A role is required as an objective and impartial evaluator.

Organization of nursing information processing learning experience: To organize the learning experience, we analyzed empirical activities that can improve the information processing capacity. Activities that can be applied within the curriculum include designing a curriculum roadmap, selecting comparisons and activities.

The road map of curriculum and non-curriculum organization of activities are shown in Table 2. The purpose and teaching methods of activities are shown in Table 3.

Evaluation of the learning experience: In order to achieve superior information processing capability, a system for competency-based evaluation based on the student's target ability should be established and a feedback device for improvement should be learned. In order to evaluate whether the goal of nursing informatics course is achieved, evaluation system was developed, criteria of performance were set and evaluation method was designed as shown in Table 4. The evaluation rubrics were developed by evaluating the achievement level of performance criteria as upper, middle and lower as shown in Table 5.

Test effectiveness of the model: Analysis of academic achievement and achievement degree of learning performance based on the above evaluation criteria.

Among the 37 students, learning performance 1 and 2 were found to be more than 'middle' but in the case of learning performance 3-5 students (13.5%) were 'low'.

Most of the 'Low' students had inefficient knowledge about nursing research and did not actively participate in activities such as statistics lectures. There

will be a necessity to find systematize ways to enhance learning performance achievement by strengthening comparison and activities in the future. This study confirmed the empirical change of teamwork ability through class and task activities of this course. After

Table 3: Purpose and teaching methods of curriculum and non-curriculum activities

Activities/Purpose	Teaching methods
Curriculum activities	
To acquire the theoretical knowledge and practical knowledge about nursing informatics	Lesson
To acquire actual nursing information processing, namely to cultivate technical ability through practical training	Special lecture, practice
Non-curriculum activities	
Learning community activity Teamwork enhancement activity Certificate acquisition activities for practical technology	Special lectures and autonomous

Table 4: Appraisal system of learning experience according to learning outcomes

Learning outcomes	Performance base	Appraisal method
Level of information theory and knowledge	Be able to learn and apply nursing informatics knowledge into work	Test score Team project assignment
Cooperation and teamwork skill	Be able to coordinate roles and tasks within team members and cooperate to complete projects	Teamwork skill appraisal 2 Peer evaluation
Data analysis ability	Be able to design nursing research model and write rele-vant paper with nursing information process competence	Individually assigned report submit research paper

Table 5: Appraisal rubrics of achievement degree of learning experience

Variables/Learning performance	Cultivating knowledge and technology of nursing informatics
1st learning outcome	
Criterion	Be able to learn and apply nursing informatics knowledge into work
Performance level	Advanced: the nursing knowledge can be applied systematically and appropriately in practice intermediate: nursing knowledge isequipped and applied to practice; low have knowledge of nursing information
Goal	70% of students achieve intermediate or above; prerequisite course: nursing informatics; required course: Excel,
Curriculum	Word processor; participation in the major study group (study community activity) test score (50 of perfect
Non-curriculum	score) team project; advanced: over 40 scores; advanced: can drive one's app with creative design and content design; intermediate: over 25 scores; intermediate: can present your design and content and run your app; low: <25 scores; low: difficult criterion to present proper contents and running application evaluation tool
2nd learning outcome	
Learning performance	Improve teamwork and cooperation; coordinate tasks and roles among team members and cooperate to complete the
Criterion	project; advanced: coordinate tasks and roles among team members and collaborate to accomplish excellent team
Performance level	projects; intermediate: coordinate tasks and roles among team members and cooperate to complete the project; low: there is difficulty in completing the project because it is difficult to coordinate and coordinate tasks and roles among
Goal	team members; 70% of students achieve intermediate or above; participation in club activity (nursing information
Non-curriculum	statistics research club) acquired M-biz maker certification; teamwork skill (survey); peer evaluation; advanced: rated
Evaluation tool	4 points or more; advanced: ranking top 1-2; intermediate: more than 3 points; intermediate: ranking top 3-5; low: <3 points; low: ranking under 6
3nd learning outcome	
Learning performance	Nursing research ability development; write a mini nursing research report through nursing information web site analysis
Criterion	advanced: can analyze the website of the nursing information by selecting the correct statistical method and write the
Performance level	mini nursing research report, excellently; intermediate: the statistical method can be applied to analyze the website
Goal	of the nursing information and create a mini nursing research report Low: there are difficulties in applying statistical
Non-curriculum	methods; 70% of students achieve intermediate or above; participation in club activity (nursing information statistics
Evaluation tool	research club) participation in special lecture on nursing statistics; research report evaluation; advanced: apply correct statistical methods of narrative and inferential statistics and complete excellent research reports intermediate: statistical analysis was conducted and the research report was submitted within the period intermediate: statistical analysis was conducted and the research report was submitted within the period

Table 6: Number of students about achievement degree of learning outcomes, N (%)

Learning outcomes	1st LO: level of information theory and	2nd LO: cooperation and teamwork nowledge	3rd LO: data analysis skill ability
Advanced	27 (73.0)	33 (89.2)	12 (32.4)
Intermediate	10 (27.0)	4 (10.8)	20 (54.1)
Low	0 (0.0)	0 (0.0)	5 (13.5)

analyzing the student's teamwork skills after the 1st and 15th lectures of the lectures, the post-test score (3.94, 0.45) was higher than the pre-test score (3.89, 0.39). The test result of education model was shown in Table 6. Number of students about achievement degree of every students reached to intermediate level in learning outcome 1 and 2. Only 5 students was low level in learning outcome 3. But this education model acquired its goal that 70 % of students achieve intermediate or above. The test results prove that curriculum and non-curriculum linkage education model is very effective to improve the nursing informatics ability. A variety of curriculum integration options ranging from concurrent teaching of related subjects to fusion of curriculum is need as Jacobs mentioned (Mortel and Bird, 2010; Jacobs, 1989).

CONCLUSION

In the meantime, the achievement of competency of nursing student by comparison and activity tended to be operated separately from the curriculum. However, applying this education model made it possible to increase synergy effect of learning achievement and increase student satisfaction by linking with the curriculum without separating from the curriculum level. Especially, it was found to be effective to link the activities of clubs, special lectures, learning communities and autonomous communities in addition, to the basic curriculum provided by universities. In the future, this study proposes to develop a competency-based curriculum linkage model to achieve learning outcomes in accordance with the characteristics of the curriculum.

Various curriculums such as basic education supplementary education-deepening education, etc., can be considered in order to link various curriculums to a series of learning outcomes. To support the curriculum management and curriculum it is necessary to construct a step-by-step capability diagnosis to demonstrate the effectiveness of education. Developing and operating a model of competency-based curriculum to achieve learning outcomes in accordance with the characteristics of the curriculum and its strategy for linking are essential.

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