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Confirmatory Study for Developing the Construction of Core Competencies of Nursing Practice

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Abstract

Aims: The purpose of this study was to develop an evaluation tool for establishing the core competencies of nursing practice programs. The construct validity of the questionnaire design was subsequently analyzed.

Methods: A total of 660 graduating nursing students were recruited. This study included the following four stages: formulation of the questionnaire content; establishing expert validity; pilot test for exploratory factor analysis; and conducting confirmatory factor analysis for confirming factor structure.

Results: After conducting exploratory factor analysis, the following two domains were identified: "advancement of practice competence" and "practice competence evaluation". Additionally, the analysis results for both structures showed a factor loading of 57%.

Conclusion: The results of this study can be used to evaluate the performance of core competencies in nursing practice programs for prospective graduates.

Keywords: Graduating nursing students; Nursing core competencies; Nursing practice program

Introduction

Nursing is a human-oriented practice discipline. Nursing education comprises lecture and clinical learning. Clinical practice is the core of nursing education and a critical educational process for nursing professional courses because the knowledge and skills learnt from nursing courses can be actually applied to clinical practice [1,2]. Numminen et al. rightly predicted that defining criteria for nursing competence would be a major issue for the 21st century [3]. In view of recent developments it appears that the need to do this is now more pressing than ever. The National Council for State Boards of Nursing (NCSBN) in the U.S. has defined competency as health care personnel applying their knowledge, social interaction, decision-making processes, and psychodynamic skills to provide health care services to people [4]. To comply with international standards, Lin et al. selected the nursing competency categories coordination, learning, administration, teamwork, self-discipline and professional development, research, technology applications and law/ethical competencies. The nursing accreditation planning department of the Taiwan Nursing Accreditation Council has established eight core professional competencies that are essential for nursing graduates. These abilities were consisted such as critical thinking, general clinical nursing skills, basic biomedical science knowledge, communication and cooperation skills, care capabilities, ethic, responsibility and a willingness to continue learning [5,6]. Therefore, it is necessary to develop the evaluation scales of practice competencies for students.

Literature review

Following advances in information technology and medical treatment standards, nursing has become increasingly complex. If the educational content of nursing programs is inadequate for application in clinical practice, nursing graduates will be unable to adapt to the clinical work environment or may experience anxiety during clinical practice. Competency refers to the achievements or capabilities of a person that are demonstrated through performance [1]. In addition, competency indicates the performance outcome, demonstrated in a work environment and involving the integration of knowledge, skill, attitude, affection, experience, value, and self-perception competencies [7,8]. Numerous studies have employed nursing competency as an indicator to evaluate educational curricula [7,9]. Nursing competency refers to the skills acquired by graduates after completing nursing education programs, and can be regarded as the outcome of nursing education.

In the study entitled, "A White Paper on Taiwan's Nursing Policy" [10], nursing was described as a practice-oriented profession. The objective of nursing education is to foster student abilities, enabling students to manage challenges that may arise during their careers. Therefore, the enhancement of nursing quality and efficacy depends on the construction of nursing competencies [1,5]. The results of the developed questionnaire can be used to construct an evaluation tool, the obtained assessment results from which can be a reference for nursing schools to improve their nursing education goals and strategic planning.

Aim

Currently, the evaluation for the core competencies have been examined previously by our faculties and competency model had been researched [1]. However, nursing practice programs for prospective graduates has not been extensively investigated. Based on previous studies [1,5], the specific abilities were proposed. Therefore, the purpose of this study was to develop an evaluation tool for establishing the core competencies of nursing practice programs. The construct validity of the questionnaire design was subsequently analyzed.

Methods

This study adopted a cross-sectional design. The evaluated nursing practice courses include basic nursing, medical and surgical nursing, obstetrics and gynecology, pediatrics, psychiatrics, and community health nursing.

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Design

The participants were prospective graduates (2 and 4 year colleges) who had studied the courses previously mentioned. This study was conducted from December 2010 to June 2011. The following four phases were conducted in this study:

Phase I: Formulation of the questionnaire content

The first phase involved the design of the study questionnaire. The scales of nursing competency categories were developed by the International Nursing Council (ICN) as the basis of our research structure. These categories were consisted such as critical thinking, general clinical nursing skills, basic biomedical science knowledge, communication and cooperation skills, care capabilities, ethic, responsibility and a willingness to continue learning.

The questionnaire content was referenced from previous studies related to education evaluations [1,6]. Thus, the first version of the practice program evaluation questionnaire was established.

Phase II: Establishing expert validity

Six nurse educators and clinical experts provided comments on the draft questionnaire. Their areas of expertise included curricula evaluation in nursing, the development of research tools, clinical practice and nursing education. The content validity index (CVI) index reached to 0.9. Thirty-item set of critical indicators of practice competence was carefully reviewed to evaluate their relevance by using a self-administered questionnaire submitted to experts of nursing clinical and education. They were asked to judge and quantify the validity of the items individually and as a set to suggest revisions and to identify areas that were missing, as recommended by Lynn and DeVellis [11,12]. Relevance was validated using a 4-point scale, where 0, not relevant, 1, relevant at novice level, 2, relevant at advanced beginner level and 3, relevant at competent level. Items with inter-rater agreement of ≥ 50% were accepted for inclusion in the scale, and this produced 21 items.

Phase III: Pilot tests

Pilot tests were conducted to assess the participants. Samples were selected from students who had completed the nursing practice curricula, comprising basic nursing, medical–surgical nursing, obstetrical nursing, pediatric nursing, psychiatric nursing, and community nursing. All of the classes were coded and six were randomly selected using a random number table. The subjects (n=249) in the pilot study were two-year and four-year graduating students. Participants completed the questionnaire and could refer any queries to a research assistant in attendance.

Exploratory factor analysis can be described as the orderly simplification of interrelated measures. EFA, traditionally, has been used to examine the potential underlying factor structure of a set of observed variables without the imposition of a preconceived structure on the outcome. With the pilot sample, principal component EFA was performed on the 21 items to extract the major contributing factors, and Varimax rotation was used to recognize relationships between items and common factors. The number of factors was decided according to the eigenvalue-greater-than-1 rule.

Phase IV: Confirmatory factor analysis (CFA)

Based on the EFA data generated by the pilot test, the questionnaire content was adjusted, and a census of the entire nursing college was conducted. Confirmatory factor analysis (CFA) was employed to validate the factor structure constructed in the prior EFA with the formal sample (N=411). Based on the calculated factor loading from CFA, convergent validity (average variance extraction, AVE) and convergent reliability (CR) can be generated for each domain (dimension). Evidence of construct validity was supported when convergent validity and convergent reliability meet the criteria (CR≥0.7 and AVE≥0.5).

Ethical Issues

This study was approved by the Institutional Review Board of National Taipei University of Nursing and Health Sciences (NTCNHS, Taiwan). Instructions and a consent form were attached to the study questionnaire. An overall analysis of the study results was conducted. Additionally, the respondents' personal information was treated as confidential.

Sample size determination

Before conducting the factor analyses (EFA and CFA), the appropriate sample size was determined. According to previous studies [13,14], the number of participants should be at least five to ten times that of the variables, but not less than 100. The questionnaire in this study contained 21 questions, therefore, at least 105 effective participants should be collected to satisfy the basic requirements for factor analysis.

Evaluation tool

The preliminary core competency questionnaire contained items regarding the following topics: "advancement of practice competence" and "practice competence evaluation." Details of the content are provided below.

Advancement of practice competence

This section included the following 15 items: (1) practice programs can enhance caring of patient; (2) practice programs can enhance team working abilities; (3) practice programs can cultivate communication; (4) practice programs can enhance self-discipline abilities; (5) practice programs can guide to consider ethical issues; (6) practice programs can enhance ability to apply basic biomedical science knowledge; (7) practice programs can concern with learning progress; (8) practice programs can benefit self-learning; (9) practice programs can enhance leadership skill; (10) assignments corresponded to the standard level of practice programs; (11) content of tests corresponded to the standard level of practice programs; (12) evaluation method was objective; (13) practice programs could achieve the goals of learning; (14) expressed passion for practice learning; (15) act as a role model in clinical practice programs. Following the quintile method, the respondents selected either strongly agree, agree, average, disagree, or strongly disagree in response to each item, and a 5-point Likert scale (5, 4, 3, 2, 1) was used to score their responses.

Practice competence evaluation

This section included the following 6 items: (1) online materials have enhanced learning of practice programs, (2) additional learning methods (e.g., separating students into groups, outdoor activities, and media-based learning materials) can enable practice goals, (3) supplementary learning guidance before practice program, (4) practice programs can stimulate creativity, (5) practice programs can improve health care skills, (6) practice programs can enhance critical thinking skills.. Following the quintile method, the respondents selected either strongly agree, agree, average, disagree, or strongly disagree in response to each item, and a 5-point Likert scale (5, 4, 3, 2, 1) was used to score their responses.

Data analysis

In this study, SPSS 15.0 statistics software was used to conduct descriptive analysis, item analysis, and EFA. SPSS Amos Version 7.0 was also employed to perform CFA.

Results

Pilot test and Item Analysis Results

The results of item analysis (Table 1) indicated the following: (1) after modifying the questionnaire content (i.e., removing questions), homogeneity tests (Cronbach's α) provided an α coefficient ranging between 0.966 and 0.964, (2) the corrected item-total correlation ranged between 0.638 and 0.826 (all P<0.001), and (3) the critical ratio (CR) t-test results were between 10.887 and 14.658 (all P<0.001) [15]. Additionally, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's test of sphericity were conducted, and the results showed a KMO index greater than 0.9 (Table 2). According to Kaiser, a KMO index between 0.8 and 1.0 indicates a goodness-of-fit. Furthermore, the results of the Bartlett's test of sphericity showed statistical significance, which indicates that at least one common factor existed among the items [16]. Therefore, the item analysis results indicated suitability for factor analysis.

EFA was performed according to the method employed in a previous study [17], where factor analysis was employed to determine the sample size. Statistical significance was achieved when the sample size exceeded 150, and the factor loading was greater than 0.45. Principal component analysis was applied to determine the factor loading. The two common factors with an eigen-value greater than 1.0 were as follows (in sequential order from highest to lowest factor loading): advancement of practice competence, and practice competence evaluation (Table 3). A total of 21 items (the 21 items included in the questionnaire after modification) were presented under these two common factors. The results for the 21 items were summarized as follows: the total factor loading was 57.43%, the item factor loadings ranged between 0.458 and 0.922, the eigen-values ranged between 1.428 and 8.188, and the overall reliability (Cronbach's α) was 0.904 indicating a good internal consistency of the scale [15].

The Formal Study

The formal investigation in this study followed the census method, where the population included prospective graduates studying at two- and four-year colleges and in-service programs. A total of 649 complete questionnaires (participants) were obtained, for a response rate of 63.3%. Based on the results of the pilot test, CFA was subsequently performed on the 411 participants. The results shown in Table 4 indicated the following: (1) for advancement of practice competence, and practice competence evaluation (a)

Table 1: Result of item analysis for the pilot sample (n=249).

*** P<0.001.

Pilot test questions	Mean	Corrected item-total correlation	α if deleting the item)	Critical ratio t-test
Online materials have enhanced learning of practice programs	3.86	0.709***	0.965	12.054***
Additional learning methods (e.g., separating students into groups, outdoor activities, and media-based learning materials) can enable practice goals	3.86	0.676***	0.965	11.196***
Supplementary learning guidance before practice program	3.89	0.701***	0.965	11.759***
Practice programs can stimulate creativity	3.90	0.737***	0.965	12.738***
Practice programs can improve health care skills	3.83	0.760***	0.964	12.234***
Practice programs can enhance critical thinking skills	3.84	0.746***	0.964	12.693***
Practice programs can enhance concern for society	3.74	0.772***	0.964	14.658***
Practice programs can enhance team working abilities	3.85	0.765***	0.964	15.890***
Practice programs can cultivate communication	3.66	0.673***	0.965	10.887***
The learning methods can enhance self-discipline abilities	3.74	0.638***	0.966	11.784***
Practice programs can guide to consider ethical issues	3.88	0.762***	0.964	13.490***
Practice programs can enhance ability to apply basic biomedical science knowledge	3.60	0.759***	0.964	13.353***
Practice programs can concern with learning progress	3.69	0.826***	0.964	16.869***
	3.84	0.732***	0.965	14.985***
Practice programs can enhance leadership skill	3.86	0.806***	0.964	13.955***
Assignments corresponded to the standard level of practice programs	3.79	0.825***	0.964	14.406***
Content of tests corresponded to the standard level of practice programs	3.70	0.764***	0.964	13.715***
Evaluation method was objective	3.57	0.781***	0.964	12.696***
Practice programs could achieve the goals of learning	3.71	0.798***	0.964	13.944***
Expressed passion for practice learning	3.86	0.806***	0.964	13.955***
Act as a role model in clinical practice programs	3.82	0.703***	0.965	11.587***

Table 2: Measure of sampling adequacy (KMO) and Bartlett's test for the pilot sample (*n*=249).

KMO measurement of sampling adequacy		**0.957**
Bartlett's test of sphericity	Approximate chi-squared distribution	4376.618
	Degree of freedom	210
	P value	<0.001

Table 3 : Summary and factor loading (after rotation) of the EFA for the pilot sample (*n*=249).

Domains	Items	Factor 1	Factor 2
Advancement of practice competence	Practice programs can enhance concern for society	0.515	
	Practice programs can enhance team working abilities	0.625	
	Practice programs can cultivate communication	0.604	
	The learning methods can enhance self-discipline abilities	0.700	
	Practice programs can guide to consider ethical issues	0.769	
	Practice programs can enhance ability to apply basic biomedical science knowledge	0.788	
	Practice programs can concern with learning progress	0.758	
	Practice programs can benefit learning;	0.860	
	Practice programs can enhance leadership skill	0.834	
	Assignments corresponded to the standard level of practice programs	0.841	
	Content of tests corresponded to the standard level of practice programs	0.731	
	Evaluation method was objective	0.763	
	Practice programs could achieve the goals of learning	0.632	
	Expressed passion for practice learning	0.578	
	Act as a role model in clinical practice programs	0.658	
Practice competence evaluation	Online materials have enhanced learning of practice programs		0.922
	Additional learning methods (e.g., separating students into groups, outdoor activities, and media-based learning materials) can enable practice goals		0.889
	Supplementary learning guidance before practice program		0.654
	Practice programs can stimulate creativity		0.736
	Practice programs can improve health care skills		0.605
	Practice programs can enhance critical thinking skills		0.585
Explained Variance (%)		19.81	34.92

Table 4: Reliability and validity analyses in CFA model for the formal sample (*n*=411).

Domain	Reliability		Convergent validity (AVE)
		Convergent reliability	
Advancement of practice competence	0.916	0.92	0.65
Practice competence evaluation	0.967	0.97	0.67
Overall	0.970	0.98	0.66

Table 5: The goodness-of-fit indices of the CFA model for the formal sample (*n*=411).

	Value of index
CMIN	724.052, df=188, P<0.001
X2/df	3.851
GFI	0.842
AGFI	0.806
SRMR	.0369
RMSEA	0.085
NFI	0.909
NNFI	0.922
CFI	0.930

the internal consistency and reliability (Cronbach's α) were 0.91 and 0.967, respectively, (b) the convergent reliability was 0.92 and 0.97, and (c) the convergent validity (AVE) was 0.65 and 0.67. (2) For the overall results (i.e., combining both structures), the internal consistency and reliability (Cronbach's α), convergent reliability, and convergent validity (AVE) was 0.97, 0.98, and 0.66, respectively. The overall model fit indices showed as the following (Table 5): GFI was 0.842, AGFI was 0.806, SRMR was 0.0369, RMSEA was 0.085, NFI was 0.909, NNFI was 0.922, and CFI was 0.930. Except for that of RMSEA, the rest model fit indices met the recommended criteria. Figure 1 showed standardized factor loading in the proposed CFA model.

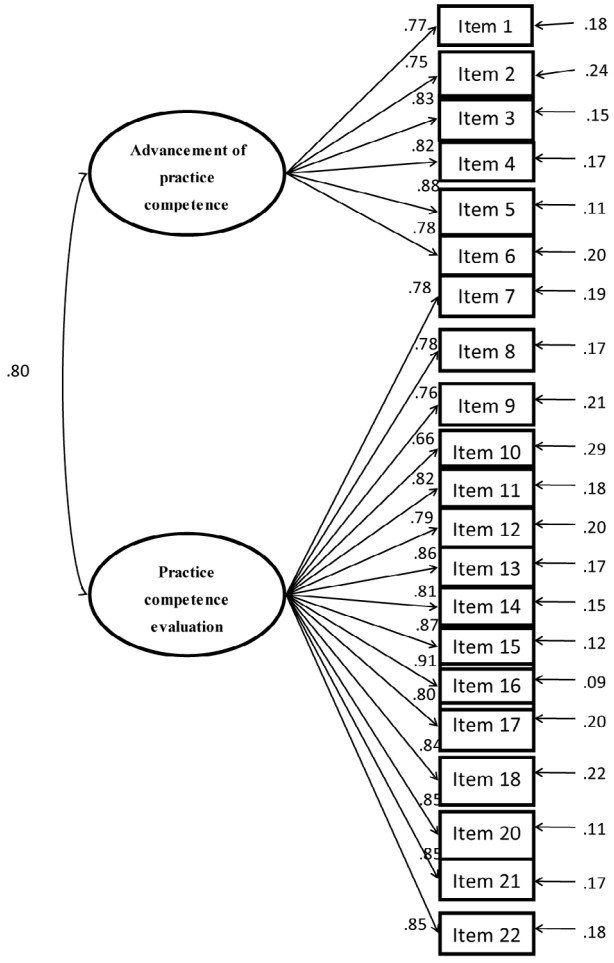

Figure 1: Standardized factor loading in the proposed CFA model (N= 411).

Discussion

Practice experience is a substantial part of nursing education. The assessment of practice competence was the core element of nursing education. Previous studies have contended that the primary goal of learning evaluation is to obtain evaluation data that can be used as a reference for supplementary learning and individual tutoring [7,18]. The purpose of the present study was to evaluate the effectiveness of establishing nursing core competencies in practice programs focusing on graduating pre-licensure students. The evaluation specifications were based on student-centered perspectives, therefore, to achieve unbiased, objective, precise, accurate, and genuine responses from students, the questionnaires were designed based on student opinions [19]. The questionnaire used in this study was designed according to the recommendations of previous researchers [19], including student self-evaluation and concentration levels. The results suggested that the correlation between the items ranged from moderate to high. The reliability analysis indicated that the questionnaire content had excellent internal consistency implying that the questionnaire could be used to test learning levels [20].

The results suggested that the EFA results obtained in this study corresponded to those of previous studies implying that graduating student core competencies could be enhanced by learning efficacy [1,21,22]. In addition, the EFA results indicated that the questionnaire was formulated to two domains according to the highest factor loading: "advancement of practice competence" and "practice competence evaluation" [23]. In the advancement of practice competence domain, this scale concerned about promoting practice competence for graduating students.

Shih indicated that students could develop competencies by understanding of practice goals and strategies [19]. Chang also mentioned that student-center based learning could elevate the competence of practice [1]. Therefore, it was important to create supportive environment to improve graduating students' practice performance. In addition, the second domain in this study is "practice competence evaluation", Rubaish and Klein showed that the content of practice learning evaluations should possess the following characteristics: correlate with the program goals, an objective evaluation method, and content that attract student interest [24,25]. Watson et al. also mentioned diverse of circumstances are created that obstruct the objective evaluation of students' performance [26]. Therefore, practice competence based evaluation could offer objective reference message to modify nursing curriculum.

Watson et al. indicated reliability (the degree to which an instrument measures consistently) and validity (the degree to which an instrument measures the construct) are basic topic in the use of measurement and should be applied strictly to the measurement of practice competence [26]. This study demonstrated the internal consistency and validity was acceptable and overall questionnaires possessed good internal consistency and reliability. Based on the EFA results, CFA was conducted to determine whether the established questionnaire agreed with the research design and assess the construct reliability and validity of the formal questionnaire. Regarding the formal questionnaire, the CFA results for advancement of practice competence, practice competence evaluation, and the overall questionnaire were conducted. These results indicated that the two domains of the formal questionnaire and the overall questionnaire content possessed good internal consistency, convergent reliability, and convergent validity [1,22,27-29]. Messick mentioned the construct validity of an instrument contained its content validity, face validity, convergent validity and discriminate validity, and is supported by the authenticity and directness of the items which the instrument contains [30]. The overall goodness-of-fit of the parameter-estimated participants were further analyzed. The results showed that all indices, excluding GFI, RMSEA, and NFI, satisfied the criteria [23,27,31].

Conclusion

In the current era of an emerging twenty-first century knowledge economy, social care has also evolved. Additionally, the continual aging of global information technologies and populations has led to changes in disease patterns and health-related issues. Nursing professionals should enhance the quality and efficacy of nursing care provided by establishing core values and increasing their position in society. Therefore, the cultivation of nurses' core competencies should be implemented from the beginning of their education. Developing the core competencies of nurses is also a crucial issue for academic fields and various industries [7,32]. In response to the changes in various global trends, nursing students are required to complete courses that develop the following characteristics: basic professional knowledge and skills, autonomy and independent thinking and judgment abilities. Therefore, the development of tools for objectively and professionally assessing the effectiveness of accomplishing core competencies is both necessary and essential. Our results showed that the evaluation questionnaire developed in this study possessed good reliability, validity, and construct validity. This questionnaire can provide data regarding nursing goals and methods to improve students' competence. Nursing educators can use the results as a reference to enhance and promote nursing education. This will enable nursing education authorities to commit to enhancing the achievement of graduating students' learning goals.

Study Limitations

In this study, the participants were primarily students enrolled in nursing practice programs, however, students specializing in other basic professions (e.g., physiology, pharmacology, and pathology) were excluded. Therefore, the results of this study cannot be applied to students studying other courses. Because of time restrictions during the research period (including the questionnaire design, pilot tests and formal investigation), the integrity of the questionnaire content may be limited. Additionally, the questionnaires were completed by the students during class time, thus, a number of the students may have been absent, thereby affecting the sample response rate. Therefore, future studies were recommended to use multiple approaches for conducting questionnaires to increase the participant response rate.

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