

## RESEARCH ARTICLE

# Transcultural adaptation and validity of the nurse professional competence scale Korean version for graduating nursing students: An explanatory factor analysis

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## Abstract

**Aim:** The study aimed to assess the validity and reliability of the short-form Nurse Professional Competence Scale–Korean version (NPC-K) among Korean nursing students at the point of graduation.

**Design:** This was a cross-sectional survey.

**Methods:** The Nurse Professional Competence scale was translated into Korean using the World Health Organization (WHO) translation method. A total of 195 graduating nursing students participated. Exploratory factor analysis for validity and Cronbach's alpha coefficients for reliability were examined.

**Results:** Factor analysis showed that five NPC-K factors accounted for 68.38% of the total variance. Cronbach's alpha for the total scale was 0.97. The NPC-K has high internal reliability and acceptable construct validity. The content of the scale reflected nursing students' confidence in formal competence requirements based on Korean cultural and educational backgrounds. An accurate assessment of nurse professional competence using the NPC-K may help nursing academics enhance the quality of education and training.

## KEYWORDS

nursing, professional competence, psychometric properties, reliability, students, validity

## 1 | INTRODUCTION

The innovation of science and technology in healthcare systems and the increased need for quality of life among patients and families demands a redesigned academic model to foster graduates with high levels of competence, knowledge and skills (Mohieldein, 2017). Bryar et al. (2011) and the World Health Organization (2001) identified a group of professional competencies for Registered Nurses (RNs) that were important for providing patients with high-quality, safe care. In particular, there is strong evidence that professional competencies,

such as Bachelor of Science in Nursing (BSN) degrees, among RNs enhance high-quality nursing care, which promotes patient safety (Aiken et al., 2014).

In Korea, the undergraduate programme aims to nurture competent nurses, and the educational content and learning process are determined by the learning outcomes (Kim, 2012a). The Korean Accreditation Board of Nursing Education (KABONE) has been evaluating the bachelor's degree programme in nursing through a 5 years certification system since 2004. In accordance with the Medical Act, all universities in Korea must obtain a nursing education certification

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evaluation (Song et al., 2019). The KABONE suggested seven core professional competencies, the direct nursing performance skills required in nurses, as goals to be achieved. The board recommended that the following 12 learning programme outcomes be reflected in the curriculum: application of comprehensive nursing practice, core basic nursing skills, therapeutic communication skills, cooperation between specialties, coordination in the healthcare team, critical thinking, understanding of the nursing professional standards, understanding of the legal and ethical standards in nursing practice, comparative analysis of nursing leadership principles, leadership in nursing teams, nursing research performance ability and the awareness of changes in healthcare policy (Bae & Park, 2013). In particular, the KABONE recommends evaluating the results of the outcome-based nursing curriculum for nursing students at the point of graduation using a measuring tool with proven reliability and validity to evaluate the achievement level and of the learning outcomes (KABONE, 2018). Despite the emphasis on establishing a nursing education system based on learning outcomes to improve the quality of nursing education in Korea, a reliable and valid nursing professional competence evaluation tool for nursing college students at the point of graduation is lacking.

## 2 | BACKGROUND

The evaluation and improvement of nursing students' competence is considered an important outcome of nursing education (Fukada, 2018). In Korea, some instruments have been developed to assess nursing students' competence. However, these developed instruments have several weaknesses when used to assess the overall competence of graduating nursing students. Most of these instruments have been developed with a focus on specific competence areas, such as nursing informatics competence (Choi et al., 2019), competence in medication activities (Park & Kim, 2019), cultural competence (Han & Cho Chung, 2015), professionalism (Yeun et al., 2005), communication (Lee et al., 2003), leadership (Jeong et al., 2003) and critical thinking (Yoon, 2004). In addition, another study was developed for graduating nursing students at one 3 years college, so there is a limit to its application to graduating nursing students of 4 years colleges (Joo & Sohng, 2014). Competence is the ability to perform tasks, effectively apply knowledge and skills, progress to desired outcomes and integrate cognitive, emotional and psychomotor domains (Meretoja et al., 2004). Considering that nursing competence includes concepts such as the ability to integrate knowledge into practice, experience, critical thinking, proficient skills, caring, communication, environment, motivation and professionalism (Smith, 2012), these scales are insufficient to comprehensively evaluate the nursing competence of nursing students at the point of graduation. Therefore, it is necessary to use a scale that comprehensively and rigorously evaluates the professional competence of university nursing students in the Korean context.

Although many instruments have been used in various countries (Cheng & Liou, 2013; Cowan et al., 2008; Lakanmaa, 2012; Lauder et al., 2008; Löfmark et al., 2006; Meretoja et al., 2004; Wangenstein et al., 2012), the Nurse Professional Competence (NPC) scale is one of the most used instruments (Xu et al., 2021). It was developed based on formal competence requirements from the Swedish Board of Health and Welfare, The Swedish Society of Nursing and WHO (Nilsson et al., 2018). It has been translated into several languages and used in several countries such as Austria, Germany, Norway, Portugal, Switzerland, Australia, the Kingdom of Saudi Arabia and Asia including China (Xu et al., 2021); it has also been used in Slovenia (Prosen et al., 2021). While most of the previously developed instruments are based on concept analysis (Takase & Teraoka, 2011), literature reviews (Cowan et al., 2008), or Benner's description of clinical practice knowledge (Meretoja et al., 2004), only the recently developed NPC was based on the official competence requirements of the Swedish Board of Health and Welfare (Xu et al., 2021). It is consistent with the six core competencies (nursing care, value-based nursing care, medical and technical care, care pedagogics, documentation and administration of nursing care and development, leadership and organization of nursing care) identified by the Swedish Academy of Nursing and the World Health Organization and the Institute of Medicine (Xu et al., 2021). The seven core competencies of nurses (integrated application ability, communication ability, critical thinking ability, research performance ability, cooperation ability, leadership ability and policy change response ability) suggested by the KABONE (2003) are also consistent with NPC's competence areas.

Originally, the NPC scale was used to assess nursing students' self-reported competence at the point of graduation and for Registered Nurses (Gardulf et al., 2016; Nilsson et al., 2018). It has rapidly spread internationally and has already been translated into several languages (Nilsson et al., 2016; NPC Research Group, 2019). However, the Korean NPC scale has not yet been validated, and its use has been limited. Although the NPC scale has already been translated and validated in other languages, there are culturally dependent elements in it, such as questionnaires on patient and caregivers' experiences, team experience and care system. Therefore, this study aimed to identify changed items of factors based on Korean nursing students' self-reported professional competence and explore the characteristics inherent in the related factor of the NPC-Korean version (NPC-K) scale. Additionally, we sought to assess the validity and reliability of the NPC-K version among Korean nursing students at the point of graduation.

The main research questions of this study were as follows.

**Research Question 1:** How did Korean nursing students self-report their nursing competence using the NPC-K Scale at the point of graduation?

**Research Question 2:** How valid and reliable is it to measure the competence of Korean nursing students at the point of graduation?

### 3 | METHODS

#### 3.1 | Design and participants

A cross-sectional research design and convenience sampling were used to test the reliability and validity of the NPC-K. The participants were students enrolled in the final year of a four-year Bachelor's Degree Program in Nursing at the Department of Nursing and were expected to graduate in February 2020. All the fourth-year students who were not expected to graduate were excluded.

According to the recommendation that 5–20 participants are required per item for an exploratory factor analysis (Stevens, 2002), the sampling of study participants was from 175 participants (35 items  $\times$  5 participants) to a maximum of 700 participants (35 items  $\times$  20 participants). With 35 items, a minimum of 175 participants were required for this study. Participants were recruited via a notice post in the fourth grade classrooms of two universities in G City. Informed written consent was obtained from all participants before the study began. A total of 243 students were enrolled and distributed through a web survey link via personal email. The two universities operated similar curricula with 130 credits (accreditation measure for how many hours a student had taken a course per semester, one credit course load = the minimum of 15hr of class per semester or minimum of 30hr of practical courses per semester) for minimum graduation completion, 70–90 credits for major elective courses and major compulsory courses. The contents of the survey consisted of 4 background questions about the participants and 35 questions about nursing professional competence, a total of 39 questions. The background questions included gender, age and the following two questions. (1) Have you ever attended any other departments before joining the Department of Nursing at our university? (2) Have you ever worked a paid part-time job at a healthcare institution while attending the Department of Nursing? Data collection was conducted through a web survey over a two-week period in December 2019.

#### 3.2 | Instrument

The initial contents of the original NPC scale consisting of 88 items were developed based on the competence requirements for Registered Nurses from the WHO (2001) and Swedish national guidelines (The National Board of Health and Welfare, 2005). A self-reported survey ( $n = 1,086$ ) was conducted for nursing students at the point of graduation with a mean age of 28.1 years (range, 20–50 years). Responses were rated on a 4-point Likert scale (that ranged from 1 to 4), and the students' professional competence was measured with Cronbach's alpha value of 0.75–0.94 in eight competence areas: Value-based nursing, nursing care, medical and technical care, documentation and information technology, teaching/learning and support, legislation in nursing and safety planning, education and supervision of staff and students and leadership in and development of nursing (Nilsson et al., 2014). Considering that a shorter NPC scale was easier to answer, a revised short version of the NPC scale was required.

The NPC research group revised the original 88 items of the NPC scale to 35 items without deteriorating in the quality (Nilsson et al., 2018). The short version of the NPC scale (NPC Scale-SF) consisted of six competence factors: value-based nursing care (five items), nursing care (five items), medical and technical care (six items), documentation and administration of nursing care (eight items), care pedagogics (five items) and development, leadership and organization of nursing care (six items). Nurse professional competence refers to these six competence areas, and to measure this, the NPC scale consists of 35 questions (e.g. do you think you have the ability to document the patient's physical condition?) that are evaluated through self-ratings. Responses were rated on a 7-point Likert scale that ranged from 1 (very low) to 7 (very high). Higher scores indicated increased competence. Cronbach's alpha coefficients ranged from 0.71 to 0.86 for the six competence factors, which indicated acceptable internal consistency.

#### 3.3 | Translation process

The NPC Scale-SF was provided with the original questionnaire after obtaining permission to use the tool from the original author via email. The NPC Scale-SF was translated from the English to Korean version (NPC-K), guided by the WHO translation method (World Health Organization, 2015). The procedure for verifying the language validity was as follows: four bilingual nursing professors translated the original questionnaire from English into Korean (forward translation). Next, a language-translation expert performed backward translation from Korean to English, and the results were reviewed by the four nursing professors. Following this, the translated questionnaires were checked by a Korean literature scholar for Korean grammar and cultural meaning. The term "next of kin" in questionnaires 6, 8, 17, 18, 19 and 20 was translated into "caregivers" in Korean, since most of the caregivers of inpatients or community indwelling patients were spouses or their offspring. "Openness to different values and faiths" in questionnaire 9 was translated into "recognizing diverse values and faiths" to improve the understanding of the concept of openness.

The revised questionnaires were reviewed by the four nursing professors again and through a pilot test of 10 nursing college students at the point of graduation, the degree of understanding of the questionnaires was evaluated, which included whether any questionnaires needed to be corrected. Next, the four nursing professors confirmed the Korean version of the NPC-K scale through discussions and consensus on the accuracy of the translation and face validity (through review comments) of the Korean version of the questionnaire tool, which included the preliminary survey results.

#### 3.4 | Pilot test

A pilot test was conducted to improve the understanding and clarity of the scale translated into Korean between February and March 2019 and targeted 10 graduating students from two universities. Based on

the opinions gathered from the participants, the final version of the tool was completed through a discussion process. The results revealed that questionnaires were generally understood; however, a clearer and more specific expression was needed. Thus, the entire term "Information & Communication Technology" was added to clarify the abbreviated expression "ICT" used in the original tool.

### 3.5 | Statistical analysis

Statistical analyses were performed using IBM SPSS version 18.0 (SPSS Inc.,) and STATA version 16.0. Descriptive statistics were used to summarize the sample characteristics. Item analysis was used to investigate whether each individual item was properly correlated with the total scale. Items with item-total correlation below 0.4 were deleted as those below 0.4 indicated less contribution to measuring the concept (Kang, 2013). An exploratory factor analysis (EFA) was performed using principal component analysis (PCA). An EFA analysis is performed to explore the characteristics inherent in the data when the respondent's reaction and perception structure to the instrument may differ depending on the characteristics, circumstances and cultural differences of the survey targets (Mahdaviyazad et al., 2018; Pett et al., 2003). Therefore, we conducted an EFA to identify the item numbers and changed items of factors in the Korean version of the NPC scale. The Kaiser-Meyer-Olkin (KMO) test and Bartlett's sphericity test were performed before the factor analysis (Hutcheson & Sofroniou, 1999). Factors with eigenvalues that exceeded 1.0, were determined to be retained; however, items with factor loadings below 0.4 were eliminated. For the reliability test, Cronbach's alpha coefficient ( $\alpha \geq 0.70$  as a satisfactory internal consistency confidence) was used to evaluate the internal consistency (Santos, 1999).

### 3.6 | Ethics

We obtained permission from the NPC Research group, along with the instrument and manual. We followed the ethical principles and guidelines for research involving human subjects of the Institutional Bioethics Committee of Chosun University (2-1,041,055-AB-N-01-2019-39). Permission was obtained from the institutional ethics review committee of the author's university. All participants signed an informed consent form after the researcher explained the purpose, content and procedures of the study. Information protection of the participants and the right to withdraw at any time were informed before the study.

## 4 | RESULTS

### 4.1 | Characteristics of the students

The general characteristics of the study participants are listed in Table 1. The mean age of the 195 nursing students at the point of

TABLE 1 Characteristics of the study participants (N = 195)

Variables	N (%)	Mean(SD)
Gender		
Men	24 (12.3)	
Women	171 (87.7)	
Age (years)		
22-23	150 (76.9)	23.49 (1.15)
24-25	35 (17.9)	
$\geq 26$	10 (5.1)	
Previous educational experience		
No	181 (92.8)	
Department of Natural Science	8 (4.1)	
Department of Social Science	5 (2.6)	
Junior College (3 years)	1 (0.5)	
Part-time job		
Yes	12 (6.2)	
No	183 (93.8)	

graduation was 23.49 years (range, 22-45 years), and the majority of the participants were women (87.7%). All participants received high school education prior to entering the university's BSN programme, as this was a mandatory requirement. Only 6.7% had completed 4 years university education in natural science or social science prior to entering the university's BSN programme, and one student had obtained a 3 years college education. Approximately 7.2% of the participants had studied other courses at the university level before entering the university's BSN programme. A majority of the participants (93.8%) did not work part time, while 6.2% worked part time.

### 4.2 | Research question 1: Students' self-reported competence

The NPC-K tended to have a slightly higher mean than the midpoint of the 7-point scale, as presented in Table 2. The highest means of NPC-K items were 5.54 for "to have a holistic view of the patient, use the knowledge and experience of team members and cooperate with the team" (Item 10) and 5.52 for "open and respectful of various values and beliefs" (Item 9), whereas the lowest means were 4.33 for "appropriate drug management by applying pharmacological knowledge" (Item 11) and 4.42 for "independently administering prescribed drugs" (Item 12). After factor loading, the highest mean of NPC-K factors was 5.27 for "value-based nursing care" (7 items), whereas the lowest mean of NPC-K factors was "development, leadership and organization of nursing care" (2 items).

Among five sub-factors, the value-based nursing care (mean 5.27, SD 0.73) and documentation and administration of nursing (mean 5.13, SD 0.84) sub-factor were reported as relatively high competence by nursing students at point of graduation. Whereas, medical technical care (mean 4.62, SD 0.82) and development, leadership and organization of nursing care (mean 4.49, SD 1.05) sub-factors were perceived as the lower level of competence (Table 3).

TABLE 2 Items analysis for nurse professional competence-Korean version (NPC-K)

Items Do you think you have the ability to ...?	NPC-K, Mean (SD)	Items with item-total correlation	Communality
1. In the nursing process, the observation and assessment steps are performed independently	4.64 (0.95)	.69	.573
2. Satisfying the patient's basic physical care needs	4.72 (0.98)	.76	.689
3. Meeting the patient's specific physical care needs	4.63 (0.97)	.79	.718
4. Record the patient's physical condition	4.95 (0.97)	.68	.644
5. Record the patient's psychological state	4.91 (1.00)	.74	.692
6. Respect patients, caregivers and staff and can communicate sensitively and empathically	5.47 (0.99)	.65	.700
7. Care and respect for patient autonomy, integrity and dignity	5.48 (0.92)	.59	.702
8. Using the experience and knowledge of patients and caregivers	5.01 (0.97)	.72	.606
9. Open and respectful of various values and beliefs	5.52 (0.90)	.59	.705
10. To have a holistic view of the patient, use the knowledge and experience of team members and cooperate with the team	5.54 (0.92)	.63	.522
11. Appropriate drug management by applying pharmacological knowledge	4.33 (1.12)	.65	.688
12. Independently administering prescribed drugs	4.42 (1.13)	.71	.768
13. Asking questions about unclear instructions or prescriptions	4.54 (1.08)	.68	.664
14. Demonstrates judgement, knowledge and thoroughness when exchanging information about the patient's safety and well-being during examination or treatment	4.75 (1.03)	.84	.745
15. Follow-up management of the patient's condition after examination and treatment	4.75 (0.90)	.85	.746
16. Handling medical products in accordance with regulations and safety procedures	4.96 (0.97)	.72	.647
17. Through dialogue with patients or caregivers, guiding and supporting them so that they can properly participate in treatment or care	5.09 (1.01)	.79	.669
18. Individually providing information and training to patients and guardians considering the timing, method and content	4.96 (0.94)	.79	.715
19. Considering the timing, method and content, providing information and training collectively to patients and caregivers	4.91 (1.02)	.77	.709
20. Make sure the patient and caregiver understand the information provided	5.09 (0.95)	.71	.735
21. Motivating patients to adhere to treatment through dialogue	5.01 (0.98)	.74	.698
22. Use of patient's relevant medical records	4.96 (0.90)	.75	.654
23. Using information and communication technology (ICT) for nursing care	4.61 (1.19)	.64	-
24. Documenting is performed in accordance with the current nursing laws	4.69 (1.08)	.70	.625
25. Comply with regulations and guidelines and procedures	5.16 (0.98)	.67	.696
26. Treat sensitive information correctly and carefully	5.24 (1.04)	.65	.756
27. Pay attention to risks during work and actively prevent them	5.32 (1.00)	.69	.759
28. Continuous participation in personal and professional competency development	5.25 (0.97)	.72	.727
29. Can systematically lead, prioritize, delegate and coordinate the team's nursing activities, taking into account patient needs and the capabilities of colleagues and staff	4.89 (1.00)	.79	.678
30. Appropriate handling of employees' unprofessional behaviour	4.81 (0.97)	.72	.608

(Continues)

TABLE 2 (Continued)

Items Do you think you have the ability to ...?	NPC-K, Mean (SD)	Items with item-total correlation	Communality
31. In case of a serious accident inside or outside a medical institution, the principle of emergency medical care is applied	4.84 (1.01)	.73	.631
32. Promote nursing activities by applying new knowledge according to science and evidence-based practice	4.81 (0.98)	.78	.650
33. Plan and discuss a series of care processes with other colleagues, exchange information and collaborate	5.15 (0.91)	.73	.615
34. Teach, supervise and assess students	4.51 (1.15)	.67	.755
35. Supervise and educate colleagues and staff	4.46 (1.12)	.62	.758

### 4.3 | Research question 2: Validation of the NPC scale

An item analysis was conducted to confirm whether the data were suitable for a factor analysis (Table 2). After the item analysis, no items were deleted as items with item-total correlation showed a distribution, which ranged from the lowest (0.59) to the highest (0.85). Items with an item-total correlation of more than 0.40 were selected (Kang, 2013). In this study, there were no items with item-total correlations lower than 0.40. Thus, the scale had 35 items in total.

An EFA analysis performed using SPSS version 18.0. yielded a Kaiser-Meyer-Olkin (KMO) value of 0.95. Hutcheson and Sofroniou (1999) mentioned that 0.8 and 0.9 were great values and above 0.9 was superb sampling adequacy. Bartlett's sphericity test resulted in  $\chi^2 = 5,525.09$ ,  $df = 595$  ( $p < .001$ ), which showed a certain correlation among the variables. Considering the results of the KMO and Bartlett's sphericity tests, the sample was considered suitable for factor analysis.

Principal component analysis (PCA) was used for factor extraction, and the obtained factors were rotated using the varimax method. The PCA revealed five factors with eigenvalues greater than 1.0, and the five factors explained 67.54% of the variance. The communalities ranged from 0.41 to 0.76, which indicated that all 35 questions met the criterion of exceeding 0.4 (Costello & Osborne, 2005). After performing the EFA for the 35-items, the factor loadings of items ranged from 0.33 to 0.80. Thus, one item (item 23), "using information and communication technology (ICT) for nursing care," was excluded due to a factor loading lower than 0.4. The remaining 34 items were analysed with an EFA again, and finally, the five factors with eigenvalues greater than 1.0 were retained. The KMO value was 0.95, the same as before, and  $\chi^2 = 5,386.96$  ( $p < .001$ ) was found to be suitable for factor analysis. In terms of the communalities, all 34 items were found to be 0.40 or more (0.41–0.76) (Table 2), and a total of the five factors explained 68.38% of the variance (Table 3). Table 3 lists the factor loadings. Among the five factors, one factor, "care pedagogics," changed the most due to the addition of other items in the original "development, leadership and organization of nursing care," "documentation and administration of nursing," and "medical technical care," and a few changes in some items were found in the other four factors.

NPC-K factor 1, "care pedagogics" accounted for 17.45% of the variance. The number of items for this

factor increased from five to 12 (four from "development, leadership and organization of nursing care," two from "documentation and administration of nursing," and one from "medical technical care") compared with the original NPC Scale-SF. NPC-K factor 2, "medical technical care" accounted for 15.91% of the variance. The number of items for this factor increased from six to eight (three from "nursing care") compared with the original NPC Scale-SF. NPC-K factor 3, "value-based nursing care" accounted for 13.42% of the variance. The number of items for this factor increased from five to seven (two from "nursing care") compared with the original NPC Scale-SF. NPC-K factor 4, "documentation and administration of nursing" accounted for 12.95% of the variance. The number of items for this factor decreased from eight to five compared with the original NPC Scale-SF. NPC-K factor 5, "development, leadership and organization of nursing care," accounted for 8.64% of the variance. The number of items for this factor decreased from six to two compared to the original NPC Scale-SF.

The internal consistency of the 34-item NPC-K with five factors was tested (Table 4). The Cronbach's alpha value for the total scale was 0.97, which exceeded 0.70 and indicated high internal consistency reliability of the Korean version of the NPC. In addition, the Cronbach's alpha coefficients for each factor ranged from 0.84–0.95. Cronbach's alpha coefficients for each factor of the NPC-K were 0.97 for care pedagogics, 0.95 for medical technical care, 0.88 for value-based nursing care, 0.89 for documentation and administration of nursing, and 0.84 for development, leadership and organization of nursing care.

## 5 | DISCUSSION

This was the first study, according to our knowledge, to assess the reliability and validity of the NPC-K scale among graduating nursing students in Korea. The original NPC scale contained items of culturally diverse items, such as patients' and caregivers' experiences, team experience and care system. Since Korea has a different healthcare system culture and experience from foreign countries, an EFA was performed to identify changed items of factors and item numbers in the Korean version of the NPC scale.

TABLE 3 Factor loadings of principal component analysis after varimax rotation

Items (n = 34) Do you think you have the ability to ...?	Factors 1	Factors 2	Factors 3	Factors 4	Factors 5
19. Considering the timing, method and content, providing information and training collectively to patients and caregivers	.68				
21. Motivating patients to adhere to treatment through dialogue	.67				
18. Individually providing information and training to patients and guardians considering the timing, method and content	.64				
20. Make sure the patient and caregiver understand the information provided	.59				
22. Use of patient's relevant medical records	.56				
17. Through dialogue with patients or caregivers, guiding and supporting them so that they can properly participate in treatment or care	.53				
30. Appropriate handling of employees' unprofessional behaviour	.52				
31. In case of a serious accident inside or outside a medical institution, the principle of emergency medical care is applied	.42				
29. Can systematically lead, prioritize, delegate and coordinate the team's nursing activities, taking into account patient needs and the capabilities of colleagues and staff					
33. Plan and discuss a series of care processes with other colleagues, exchange information and collaborate					
15. Follow-up management of the patient's condition after examination and treatment					
32. Promote nursing activities by applying new knowledge according to science and evidence-based practice					
12. Independently administering prescribed drugs		.80			
11. Appropriate drug management by applying pharmacological knowledge		.76			
13. Asking questions about unclear instructions or prescriptions		.71			
3. Meeting the patient's specific physical care needs		.61			
16. Handling medical products in accordance with regulations and safety procedures		.55			
2. Satisfying the patient's basic physical care needs		.54			
14. Demonstrates judgement, knowledge and thoroughness when exchanging information about the patient's safety and well-being during examination or treatment		.53			
1. In the nursing process, the observation and assessment steps are performed independently		.49			
7. Care and respect for patient autonomy, integrity and dignity			.78		
6. Respect patients, caregivers and staff and can communicate sensitively and empathically			.74		
9. Open and respectful of various values and beliefs			.73		
8. Using the experience and knowledge of patients and caregivers			.56		
5. Record the patient's psychological state			.54		
4. Record the patient's physical condition			.50		
10. To have a holistic view of the patient, use the knowledge and experience of team members and cooperate with the team			.49		
26. Treat sensitive information correctly and carefully				.80	
27. Pay attention to risks during work and actively prevent them				.76	
25. Comply with regulations and guidelines and procedures				.70	
28. Continuous participation in personal and professional competency development				.66	
24. Documenting is performed in accordance with the current nursing laws				.57	
35. Supervise and educate colleagues and staff					.76
34. Teach, supervise and assess students					.74
Mean (SD)	4.94(0.77)	4.62(0.82)	5.27(0.73)	5.13(0.84)	4.49(1.05)
Eigen-value	5.93	5.41	4.56	4.40	2.94
Explained proportion (%)	17.45	15.91	15.91	12.95	8.64
Cumulative proportion (%)	17.45	33.37	46.79	59.74	68.38

NPC scale-SF factor structure	Cronbach's alpha ( $\alpha$ )	NPC-K factor structure	Cronbach's alpha ( $\alpha$ )
Factor 1. Nursing care; 5 items	0.76		
Factor 2. Value-based nursing care; 5 items	0.71	Factor 3. Value-based nursing care; 7 items	0.88
Factor 3. Medical technical care; 6 items	0.79	Factor 2. Medical technical care; 8 items	0.95
Factor 4. Care pedagogics; 5 items	0.82	Factor 1. Care pedagogics; 12 items	0.97
Factor 5. Documentation and administration of nursing; 8 items	0.86	Factor 4. Documentation and administration of nursing; 5 items	0.89
Factor 6. Development, leadership and organization of nursing care; 6 items	0.84	Factor 5. Development, leadership and organization of nursing care; 2 items	0.84
Overall scale	0.98	Overall scale	0.97

TABLE 4 Comparison between the original NPC scale short form (SF) 35-items and the new NPC-K 34-items

In South Korea, nursing colleges are obligated to undergo regular national certification evaluations to ensure that students have achieved the programme outcomes required by the KABONE. Most accredited universities use evaluation methods such as graduation exams, questionnaires, practical exams, practical subject ratings, problem-solving checklists and reports as programme outcome data (KABONE, 2014). There is a concern that the management and improvement of student learning outcomes may be omitted when such a method is applied based on the instructor's final evaluation. It is important to check the students' performance levels and provide feedback on the concept of the learning outcomes (Kim, 2012b). Thus, the NPC-K scale for self-reported student competencies can be useful for improving the management of student learning outcomes.

Except for one item, 34 items in the NPC Scale-SF were successfully identified in the NPC-K in our study. The item excluded from NPC Scale-SF was "using information and communication technology (ICT) for nursing care" (Item 23) as the factor loading was 0.33. This reflected the cultural differences in nursing education. In particular, it can be interpreted since access to electronic health records was limited due to personal privacy protection in clinical practicum. In Korea, the core competencies of nurses are categorized into the following seven areas by KABONE according to the definition of nursing competence by the National League for Nursing and American Association of Colleges of Nursing: Interdisciplinary communication and collaboration; Integrating knowledge and skills; Critical thinking skills; Leadership skills; Conducting research; Awareness of legal and ethical responsibilities; and Responding to changes in health policies (Lee et al., 2019). In other words, the curriculums of Korean nursing colleges rarely deal with competence evaluation for the ability to use ICT in the areas of "documentation and administration of nursing care." The NPC Scale was developed on the basis of competence requirements for Registered Nurses and was intended to self-evaluate not only nursing students but also nurses who worked in hospitals with high-tech systems (Nilsson et al., 2018). Therefore, item 23

was included in the NPC scale. In contrast, in the study on the Chinese version of the NPC Scale-SF for nursing students nearing graduation, factor loading of item 12 (ability to independently administer prescriptions) was 0.28; however, it was judged as a core competency of safety and the item was retained (Xu et al., 2021).

Among the six-factor NPC Scale-SF one competence factor (nursing care) was crossed over to the two existing factors (medical technical care and value-based nursing care) in our study, which resulted in a total of five competence factors in the NPC-K scale. Also the factor "medical technical care" was renamed to "medical technical care and nursing care" since the existing factor "nursing care" was mainly moved to factor "medical technical care." In this study, the overall Cronbach's alpha was 0.97, and the internal consistency coefficients ranged from 0.84 to 0.97. The results of this methodological study were consistent with the original NPC Scale-SF's internal consistency coefficients of 0.71–0.86 and the overall alpha coefficient of 0.98 (Nilsson et al., 2018) and the Saudi Arabia nurses' NPC Scale-SF's internal consistency coefficients of 0.86–0.93 (Halabi et al., 2021). Moreover, in a study on the Chinese version of the NPC Scale-SF for nursing students nearing graduation, the total scale Cronbach's alpha was 0.97, the same as in our study (Xu et al., 2021). The psychometric properties of this study provide evidence that the NPC-K has adequate internal consistency for Korean students at the point of graduation.

A culture-related outcome was found for items related to the five competence factors. Major changes were found in the items that assessed competence for the factor "care Pedagogics." The items "appropriate handling of employees' unprofessional behavior" (Item 30), "in case of a serious accident inside or outside a medical institution, the principle of emergency medical care is applied" (Item 31), "promote nursing activities by applying new knowledge according to science and evidence-based practice" (Item 32), "plan and discuss a series of care processes with other colleagues, exchange information and Collaborate" (Item 33) moved to the factor "care pedagogics." The study participants might have perceived these four items as



among those for comprehensive “care pedagogics” rather than items of “development, leadership and organization of nursing care.” This result was expected since although there were “leadership skills” in Korean nurses’ core competence and “demonstrates leadership ability” in Korean nursing programme outcomes, the learning objectives of actual curricula were heavily focused on the application of comprehensive nursing practice and critical thinking of the nursing process (KABONE, 2013). Indeed, students may consider leadership a more necessary competence for nursing managers, such as head nurses, than for nursing students (Bae & Park, 2013). Similarly, “use of patient’s relevant medical records” (Item 22), “can systematically lead, prioritize, delegate and coordinate the team’s nursing activities, taking into account patient needs and the capabilities of colleagues and staff” (Item 29) and “follow-up management of the patient’s condition after examination and treatment” (Item 15) were moved to “care pedagogics.” This phenomenon may reflect that “use of relevant data,” “team lead and development,” and “follow-up on patient’s conditions” might also be included in assessment contents of “care pedagogics.” In the study of the instrument developed for junior college students in Korea, the factors were “nursing professionalism,” “integrated nursing through critical thinking,” “communication skills,” “nursing leadership,” “respect of life,” “stress management,” “nursing research,” and “core nursing skills” (Joo & Sohng, 2014) and compared to these factors, the NPC scale factor such as “care pedagogics” can be regarded as a relatively high abstraction concept.

In Korea, almost all studies on the development of nursing competence evaluation tools have been conducted on nurses, and there are few studies on senior or nursing students on the point of graduation (Joo & Sohng, 2014). In other countries, there were a few nursing competence assessment tools in order to evaluate the preparation or competences for nursing students on the point of graduation as a Registered Nurse. Klein and Fowles (2009) evaluating the adequacy of competences rated by senior nursing students, Six-dimension Scale of Nursing Performance (Six-D scale) were categorized by four factors: (1) simulation/skill verification; (2) traditional methods of instruction/evaluation; (3) Competency Outcomes Performance Assessment model indicators; and (4) student-focused learning strategies. In addition, Hsu and Hsieh (2013) developed the Competency Inventory of Nursing Students (CINS) and assessed six factors: (1) ethics and responsibility, (2) general clinical skills, (3) life-long learning, (4) clinical biomedical science, (5) caring and (6) critical thinking reasoning. However, these tools lacked development, leadership and organization of nursing care for nurse professional competence areas and focused primarily on caring and clinical practice. The study of Kajander-Unkuri (2015) suggested nine evaluation areas (1) professional/ethical values and practice, (2) communication and interpersonal skills, (3) knowledge and cognitive ability, (4) nursing skills and interventions, (5) assessment and improving quality in nursing, (6) professional development, (7) teaching and supervision, (8) leadership, management and teamwork and (9) research utilization) through a literature review on general nursing competence, but this focused on nursing skills, knowledge and moral and was insufficient to evaluate nursing administration and organization.

Also, Nurse Competence Scale (NCS) was often used to assess competence of newly graduated nurses (Lima et al., 2014; Numminen et al., 2016; Wangenstein et al., 2012); however, NCS based on Benner’s from Novice to Expert framework was developed and validated to assess nurses’ generic competence rather than nursing students on the point of graduation (Flinkman et al., 2017).

The sub-items of the NPC-K’s other four competence factors were interesting and culture-specific. Compared to the original NPC Scale-SF, in the NPC-K, the sub-items in the areas “value-based nursing care” and “medical technical care and nursing care” increased. The basic knowledge, skills and attitude of nurses seem to be related to the following Korean nursing programme outcomes: “application of comprehensive nursing practice,” “core basic nursing skills,” “therapeutic communication skills,” “cooperation between specialties,” “coordination in the healthcare team,” “critical thinking,” “understanding of the nursing professional standards,” and “understanding of the legal and ethical standards in nursing practice.” In addition, Korean students recognized “core basic nursing skills” as the most important among nursing programme outcomes in Korea and showed a high level of achievement (Choi et al., 2014). As this study was based in Korea, where nursing colleges must be accredited by KABONE, the cultural context in which nursing colleges operate the curriculum centred on important programme outcomes may have been reflected.

However, compared to the original NPC Scale-SF, in the NPC-K, the sub-items in areas of “documentation and administration of nursing” and “development, leadership and organization of nursing care” decreased. As hospitals require nurse leadership and organizational management and are equipped with high-tech systems of care and documentation (Powell et al., 2008), these competence factors may be more specific to nurse practitioners than to nursing students in college.

The results showed that the lowest self-reported competence in NPC-K was for “development, leadership and organization of nursing care.” Similar results were reported by Halabi et al. (2021), Forsman et al. (2020) and Gardulf et al. (2016). However, in a study on Chinese nursing students, “nursing care” was the lowest factor (Xu et al., 2021). Hence, there was a difference in China. Even in a study on nurses, the low mean in this competence factor is since most nurses are in bedside nursing care and only a few are in leadership management and organization positions (Halabi et al., 2021). In contrast, the highest reported mean score competence in NPC-K was in the “value-based nursing care.” This competence area also reported a high mean score in studies conducted by Halabi et al. (2021), Xu et al. (2021), Forsman et al. (2020) and Gardulf et al. (2016). However, in our study, nursing students reported the “care pedagogic” competence as a medium ranking, similar to Swedish students (Forsman et al., 2020). In contrast, in previous studies, nurses reported this factor as the lowest rank (Halabi et al., 2021), and Chinese students reported that it as a high rank (Xu et al., 2021). The reason for the low score in Halabi et al. (2021) was that patients and their families would not be able to participate, communicate and understand the information provided by most nurses if the language was different.

Thus, checking the students' competence status with the students' scores revealed the lowest reported competencies as areas with potential for development and improvement, which can help professors guide students and provide relevant feedback.

A limitation of the present study is that the sample originated from only two universities in Gwangju City, Jeollanam-do region of Korea. However, the sample included nursing students represented by fourth-year students in Korea who have completed a standard nursing curriculum at a university accredited by KABONE. To generalize this study, future studies should include a variety of students and Registered Nurses and increase the sample size and representation from different regions and settings. Based on this result, a confirmatory factor analysis study is recommended to provide information on the latent constructs by accounting for the association between the variables. This study analysed the NPC scale in the Korean educational context, and there may be differences in interpretation compared to other NPC scales because the items of the factors have been changed.

## 6 | CONCLUSION

A growing trend of nursing education in Korea is outcome-oriented education, with greater emphasis placed on achieving the learning outcomes outlined in the curriculum. This study verified that the NPC-K was a reliable and valid scale for assessing the various competence areas of learning outcomes in nursing students' bachelor's nursing curricula. It supports the intercultural applicability of the concepts, including NPC-K and suggests that nursing professional competence transcends cultures. The core competencies required of newly Registered Nurses in Korea were the essential knowledge, skills, attitudes and ability to perform specific tasks expected of bachelor's degree nurses in nursing practice. Therefore, our findings provide evidence for the self-reported competence assessments of newly Registered Nurses and nursing students and the identification of competence areas with potential for improvement. When using the NPC-K, the cultural modifications in our study, such as nursing care competence and different views on the items of competence factors, should be considered. Currently, there is insufficient research on the Self-Reporting Competence Evaluation Scale in Korea. Future research using qualitative research is recommended to grasp a unique perspective on the competence factors of Korean nursing college students and utilize the scale for evaluating the programme outcomes of Korean nursing education.

## DATA AVAILABILITY STATEMENT

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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