

# Confirmatory Factor Analysis Affecting Aptitude in the Specialized Nursing Competency of Nursing Students

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## Abstract

The objective of the research is to explore the consistency of specialized nursing competency models of nursing students. The participants in this research are 165 Year 4 nursing students at Boromarajonani College of Nursing, Chakriraj, Thailand. The data was collected using a questionnaire consisting of 45 questions, answered with the use of a 5-level scale. The questionnaire was evaluated by three experts, and the questionnaire's accuracy ratings ranged from .70 to 1.00. The internal reliability of the questionnaire was measured using Cronbach's alpha coefficient, resulting in values of .763 for educational excellence, .757 for socio-economic factors, .806 for lifestyle, and .814 for personal factors. The study's findings showed that competency. 1) Education throughout nursing student training. 2) The socio-economic context. 3) Habits pertinent to everyday existence. 4) Attitude towards the nursing profession. 5) GPAX represents the grade point average. 6) OSCE refers to the objective structured clinical examination. The confirmatory factor analysis of specialized nursing aptitude is consistent with the empirical data, Chi-Square = 14.226; df = 8; Relative Chi-Square = 1.778; p-value = .076; GFI = .974; NFI = .943; TLI = .951; CFI = .974; RMSEA = .069; RMR = .113. Each element has a standard element weight value of between .010 and .817, with a standardized weight value ranging from .010 to .817.

**Keywords:** confirmatory factor analysis, nursing student, nursing aptitude

## 1. Introduction

### 1.1 Introducing the Problem

Education is an important issue for all of humanity. Learning knowledge and developing skills may greatly contribute to an individual's ability to establish a successful professional path (Intrarakumhang & Ruangrit, 2016). The nursing profession necessitates the provision of compassionate and attentive care to individuals (Angkana et al., 2018). To excel in the nursing profession, it is necessary to possess a deep sense of enthusiasm, derive satisfaction from academic pursuits, and demonstrate a high degree of selflessness. The duration of a nursing program in Thailand is typically four years. is an esteemed educational institution with a long tradition – over 30 years - of educating nurses. Upon completion of their studies, graduates are required to fulfill professional obligations in diverse healthcare settings, mostly hospitals. However, it is worth noting that a significant proportion of these graduates encounter challenges in effectively navigating the intricacies of patient care inside healthcare facilities (Khemapech, 2015).

Furthermore, there is a scarcity of nurses available for clinical practice. The nurses lack the requisite ability needed for their profession. Consequently, they commonly choose to transition into employment inside private agencies, and explore a career shift because of experiencing dissatisfaction in their previous occupation (Klaharn, 2014). To effectively engage in work which provides a sense of contentment, it is important to possess a combination of knowledge, skills, and aptitudes. To acquire the necessary skills and expertise, anyone aspiring to become a nurse must engage in a process of learning and diligent practice. It is possible that students may lack awareness of their aptitudes. This phenomenon results in a diminished sense of self-assurance in the execution of requisite tasks (Sunan & Cherdsak, 2018). Nursing graduates may have a lack of aptitude and a limited understanding of their own unique talents and abilities (Dutwan, 2017). Therefore, the on-going increase in the turnover rate might be

attributed to a degree of job dissatisfaction.

Persons who have awareness of their aptitudes are likely to succeed better in their occupations compared to those who lack such self-awareness (Kruttakart et al., 2015). This can be because knowledge of one's aptitudes enables one to align one's abilities and skills with the requirements of one's work (Watson et al., 2013), thereby enhancing one's overall job performance. Living while still a student will help one develop one's aptitude and translate it into practical skills.

### *1.2 Exploring the Importance of the Problem*

The cost of a complete nursing degree program can be as much of 440,000 baht per individual (HFogus, 2019). Nevertheless, a significant percentage of recently graduated nurses discontinue the pursuit of a nursing career every year. Based on data provided by the Nursing Council, it is observed that 48.86 percent of recently graduated nurses discontinue their employment during the first year, then another 25 percent in the following year. The average duration of a nurse's professional tenure is reported to be 22.5 years, with an attrition rate of 4 percent, equivalent to almost 7,000 individuals (HFogus, 2023). Furthermore, the compensation provided does not align proportionally with the amount of effort required. These circumstances fail to align with the prevailing economic conditions, leading to work dissatisfaction that does not align with an individual's inherent abilities. Consequently, the nation incurs significant financial loss on an annual basis.

The significance of doing a review of the existing body of literature pertaining to specialized nursing competencies, encompassing both national and global contexts (Saranit et al., 2022), is therefore paramount. The constituents and signs of such ability have not yet been investigated.

Consequently, the researcher is motivated to investigate the constituents of specialized nursing aptitude through the application of affirmative (Amershi, 2009) component analysis methodologies (Khumyu et al., 2021). This approach aims to identify, precisely and accurately, the elements that may serve as a framework for the enhancement of the curriculum of the Bachelor of Nursing degree. By ensuring a genuine aptitude among nursing students, this project will ultimately contribute to the attainment of a high level of proficiency in the field. Nursing graduates are poised to play a pivotal role in safeguarding the overall well-being of the Thai populace.

### *1.3 Hypotheses and Their Correspondence to the Research Design*

Confirmatory factor analysis () is a statistical method that can be used to assess the underlying structure of a set of observed variables. CFA can be used to identify the latent factors that influence aptitude with regard to specialized nursing on the part of nursing students.

To conduct a CFA, researchers first develop a hypothesized model of the latent factors that they believe influence aptitude with regard to specialized nursing on the part of nursing students. The researchers then collect data on a set of observed variables that are thought to be measures of the latent factors. The CFA model is then tested using the observed data (Chang, 2013). If the CFA model fits the data well, then this suggests that the latent factors are accurately represented by the observed variables. The researchers can then use the CFA results to identify the latent factors that have the strongest influence on aptitude with regard to specialized nursing on the part of nursing students (Singh, 2020). A few CFA studies have been conducted with regard to this aspect. These studies have identified several latent factors that influence such aptitude (Zhao et al., 2021). These are:

- Clinical skills: This latent factor is associated with the ability to perform specialized nursing procedures.
- Knowledge: This latent factor is associated with knowledge of specialized nursing topics.
- Attitudes: This latent factor is associated with attitudes towards specialized nursing practice.

## **2. Method**

### *2.1 Identify Subsections*

CFA is a mainly dis-confirmatory quantitative data analysis method that belongs to the family of structural equation modeling (SEM) techniques. CFA allows for the assessment of fit between observed data and an a priori conceptualized, theoretically-grounded model that specifies hypothesized causal relations between latent factors and their observed indicator variables.

In this article, typical steps in a CFA are introduced. First, during model specification, a model is conceptualized by indicating how latent, unobserved factors relate to measurable variables. Second, if each parameter can be expressed as a function of the variances and covariances of observed variables, model identification is assured, and parameters can be estimated. Third, iterative techniques such as the maximum likelihood, generalized least squares, or asymptotically distribution free estimation methods can be utilized to estimate the unknown model

parameters. Fourth, assessments of fit between observed data and the a priori specified model(s) can be made via a multitude of absolute, parsimonious, and incremental fit indices. Fifth, if data-model inconsistencies are observed, model modifications might be appropriate, provided they are consistent with underlying substantive theories and the modified model is cross-validated using an independent sample. The article closes with applied and methodological references appropriate for a more in-depth study of CFA and SEM in the social and behavioral sciences (Mueller & Hancock, 2001).

The research hypotheses about the use of statistics and element analysis are as follows: 1) Variables may be expressed as continuous numbers, interval scale, or ratio scale. 2) A strong correlation between variables ( $r = 0.30-0.70$ ) is preferred, with the relationship pattern between elements and variables being strictly linear. 3) It is recommended that the quantity of variables chosen for element analysis exceeds thirty. 4) It is recommended that the sample size be substantial, greater than or equal to 5 to 10 times the number of variables. The proportion should be three samples to one variable. 5) Principal component analysis: While a normal distribution is not a prerequisite for variables, the outcome may be erroneous if certain variables exhibit significantly asymmetrical distributions, and possess atypical minimum and maximum values (outliers).

## 2.2 Participant Characteristics

This study aims to explore the topic of specialized nursing aptitude and its components among nursing students. It seeks to synthesize existing research on this subject by employing selection criteria that align with other studies that have yielded comparable findings. The study of the CFA with regard to specialized nursing aptitude is based on the standards of the examination for registration as a nurse practitioner of the Thailand Nursing and Midwifery Council (Thailand Nursing and Midwifery Council, 2022).

The elements comprising nursing aptitude can be succinctly categorized into six components: 1) The educational journey of a nursing student over time. 2) The influence of socioeconomic factors on nursing education. 3) Habits pertinent to everyday existence. 4) Attitude towards the nursing profession 5) GPAX represents the grade point average. 6) OSCE refers to the objective structured clinical examination.

## 2.3 Sampling Procedures

### 2.3.1 Sample Size, Power, and Precision

The study population consisted of fourth-year nursing students who were qualified to register for the nursing and midwifery professional license registration test in the academic years 2018 and 2019. A sample size of 165 participants took part in the research using selection of all samples.

### 2.3.2 Measures and Covariates

The data collection instrument employed in this study was a questionnaire designed to assess the various dimensions of specialized nursing aptitude. The researcher developed this questionnaire by synthesizing the components of specialized nursing aptitude that have been consistently identified in previous studies with similar characteristics. This synthesis was achieved through a comprehensive review of the relevant research literature, followed by data synthesis and the construction of a conceptual framework. Following that, a draft questionnaire was developed to measure specialized nursing aptitude. To ensure the quality of the instrument, the researcher made use of the input of three experts who were invited to evaluate the questionnaire's validity and item objective congruence (IOC). Items with an IOC value equal to or greater than 0.50 were considered acceptable. To assess the instrument's reliability and internal consistency, Cronbach's alpha coefficient was applied. The scores obtained were .763 for educational excellence, .757 for socio-economic factors, .806 for lifestyle, and .814 for attitude factors. Additionally, data from the student registration database, specifically GPAX and OSCE data, were incorporated.

The data collection process extended over two years because of the need to await the fulfillment of the selection criteria on the part of the sample, namely their success in the exams leading for the qualification for registration for the nursing and midwifery profession.

### 2.3.3 Research Design

The study was approved by the research review committee at Boromarajonani College of Nursing, Chakriraj, Ban Pong District, Ratchaburi, Thailand. Informed consent was obtained from the participants before investigation. The confidentiality of the participants was protected during the process of collecting data for the research. Furthermore, it is important to note that these students has the option to withdraw from the research project at any given point if they so desired.

The research procedure comprised the following stages:

- 1) The clinical skills assessment procedure (OSCE) gathered data pertaining to pertinent courses through the administration of base. The test results were evaluated using a 5-point rating scale, and the scores from all base that were examined are aggregated.
- 2) The survey consisted of a set of 10 educational characteristics, each rated on a 5-point scale from the lowest to the highest.
- 3) In the questionnaire on student life behavior the participants responded to 10 questions. The rating scale was categorized into 5 levels going from the lowest to the highest.
- 4) The professional attitude questionnaire consisted of 15 items and utilized a 5-level rating scale, from the lowest to the highest.
- 5) The socioeconomic factors questionnaire consisted of 10 items that utilized a 5-level rating system, from the lowest to the highest.
- 6) The grade point average (GPA) statistics of students spanned from their first year to their fourth year, as well as the GPAX received from the education registration and processing system, were analyzed.

The software applications employed for data analysis encompass SPSS and AMOS, with an IBM order reference number of 63479398.

### 3. Results

A comprehensive questionnaire consisting of nursing aptitude components was utilized to examine the issues in question. The researcher conducted an examination of the overall data utilizing fundamental statistical measures, specifically the mean and standard deviation (SD), through the application of Pearson's correlation coefficient analysis. The results show that all components showed statistical significance at a significant level of .01 (as shown in Table 1). This level of significance is acceptable for conducting confirmatory factor analysis, as it aligns with the statistical measures used to assess the fit of the model, specifically the Chi-Square ( $\chi^2$ ) statistic.

The Integration Indicator, also known as the goodness-of-fit index (GFI), adjusted the goodness-of-fit index (AGFI), and the normed fit index (NFI). It is a set of statistical measures commonly used in academic research. It includes estimation tolerance, which includes the root mean square error of approximation (RMSEA), the root mean residual (RMR), and the standardized root mean square residual (SRMR). The comparative integration level index (CFI) is employed to assess the congruity between the elemental hypothesis model and the empirical data.

Table 1. The relationship between specialty nursing aptitude characteristics

Factor	Education	Social	Lifestyle	Attitude
1. Education				
2. Social	.589**			
3. Lifestyle	.571**	.495**		
4. Attitude	.390**	.558**	.572**	

p < .01

#### 3.1 Results of the Level of Response for the Four Specialty Nursing Aptitude Characteristics

The results of the level of response for the four specialty nursing aptitude characteristics are adequate. They consist of:

- 1) The average score for education while a nursing student: 3.45 (S.D.=0.39).
- 2) The average score for social: 3.48 (S.D.=0.45).
- 3) The average score for lifestyle: 3.62 (S.D. = 0.50).
- 4) The average score for attitude conduct: 4.02 (S.D. = 0.46).

Table 2. Level of response for the four specialty nursing aptitude characteristics (N=165)

Factor	Mean	S.D.
1. Education	3.45	0.39
2. Social	3.48	0.45
3. Lifestyle	3.62	0.50
4. Attitude	4.02	0.46

3.2 Results of the Standardized Regression Weights.

The standardized regression weights indicate that the education variable displays the highest loading value of .817, while the GPAX variable has the lowest loading value of .010. Additionally, the attitude variable demonstrates a loading value of .790, followed by the social variable with a loading value of .710, and the lifestyle variable with a loading value of .713.

Table 3. Standardized regression weights

Assessment issues	Estimate	S.E.	C.R.	P
GPAX	.010	.036	.118	.906
Attitude	.790	.768	.955	.340
Lifestyle	.710	.752	.956	.339
Social	.713	.682	.956	.339
Education	.817	.679	.955	.340

3.3 Results of the Confirmatory Factor Analysis of Specialized Nursing Aptitude

The CFA of specialized nursing aptitude is as shown in Figure 1.

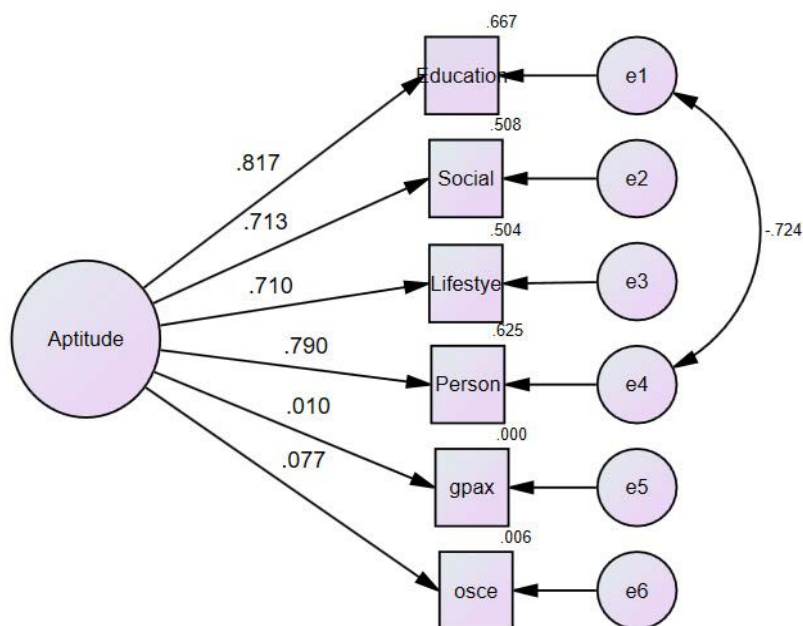


Figure 1. Confirmatory factor analysis of nursing specialized aptitude

Figure 1 represents the CFA of specialized nursing aptitude consistent with the empirical data: Chi-Square = 14.226; df = 8; Relative Chi-Square = 1.778; p-value = .076; GFI = .974; NFI = .943; TLI = .951; CFI = .974; RMSEA = .069; RMR = .113.

Table 4. Showed evaluation outcome

	Statistic Values	Evaluation Outcome
Chi-Square	14.226	Models align with empirical evidence.
df (Degree of Freedom)	8	over-identified model
Relative Chi-Square	1.778	Good
p-value	.076	not significant
GFI	.974	Good
NFI	.943	Good
TLI	.951	Good
CFI	.974	Good
RMSEA	.069	Fair
RMR	.113	Models align with empirical evidence.

The study revealed that the attributes associated with specialized nursing ability encompass 6 factors as follows: 1) The impact of education on nursing students: A study on 10 indicators. 2) The socio-economic conditions refer to the social aspects of the economic circumstances: 10 indicators. 3) Lifestyle factors: 10 indicators. 4) Personal behavior factors: 15 indicators. 5) GPAX factor: 4 indicators. 6) OSCE factor: 5 indicators.

This system is commonly used in academic institutions to assess and evaluate students' academic performance. The topic of discussion pertains to the five indicators with regard to the objective structured clinical examination (OSCE). The weight values of standard elements span a range of 0.010 to 0.817.

#### 4. Conclusion

The aptitude for specialist nursing is confirmed through the utilization of component analysis. The findings may be analyzed and interpreted in the following manner:

The characteristic of specialty nursing aptitude has 6 separate elements and includes a total of 54 indicators. These indicators comprehensively address all aspects pertaining to specialized nursing aptitude.

Engaging in academic pursuits when enrolled as a student exemplifies a characteristic indicative of scholarly accomplishment from the initial year of study. Understanding one's aptitudes is beneficial for students as it facilitates their adjustment to college life, and aids in the development of their aptitude repertoire. There is a relationship between confidence and satisfaction in terms of task performance (Meng & Jin, 2017).

Socio-economic factors have a significant role to play in alleviating students' concerns with regard to learning, particularly in the context of nursing education, which incurs substantial financial expenses. Nevertheless, within each college of nursing, students have the opportunity to mitigate expenses through having access to on-campus dorms and scholarships specifically designed to support their financial needs. Students who have familial challenges benefit from the presence of a teacher who assumes a surrogate parental role, so fostering a sense of well-being and contentment throughout their academic life (Brigman et al., 2015).

Given that students dedicate a significant portion of their life to pursuing higher education, the provision of learning support services plays a crucial role in ensuring their overall well-being and security. With the availability of round-the-clock internet access, students could stay at their college campuses over weekends, particularly important for those who reside far away. This allows them to establish stronger connections with their educational institution and dedicate ample time to refining their abilities and talents (Herwin & Nurhayati, 2021).

Attitude conduct. Given the diverse cultural backgrounds of students, the provision of mentorship by teacher advisors and the cultivation of seniority enable students to actively pursue knowledge. There is considerable variation in attitude, while there also exist variability in individuals' analytical talents. Certain attitudes allow the students to possess the capacity to acquire knowledge at an accelerated rate. Having a specialization in nursing has a significant impact.

Based on the findings with regard to GPA studies, the evidence suggests that there is a limited association between specialized nursing aptitude and other contributing factors. Furthermore, the existing body of research has not shown any conclusive results indicating a correlation between subject-specific scores and nursing aptitude or abilities (Saranit et al., 2022).

The findings with regard to the OSCE results indicate that the competencies honed by students during the OSCE examination are conducive to achieving excellence in specialized nursing. This can be attributed to the fact that the OSCE test provides students with an opportunity to practice skills that closely resemble those encountered during

internships, hence fostering the development of specialized proficiencies rather than relying solely on classroom-based learning (Oosterhoff et al., 2022).

The six elements of specialized nursing aptitude characteristics displayed by nursing students align with actual evidence to a satisfactory degree. This model may be utilized for the purpose of predicting aptitude in specialized nursing.

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### **Competing interests**

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

### **Informed consent**

Obtained.

### **Ethics approval**

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The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

### **Data sharing statement**

No additional data are available.

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