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Original Article

Factors influencing clinical competency among nursing students at a regional training center: a cross-sectional study

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Abstract

Background & Objective: Nursing education in Cambodia currently faces considerable challenges in developing clinical competency due to limited institutional resources and a lack of empirical research evidence. This study aimed to identify key factors affecting clinical training and the development of clinical competence, confidence, and awareness among nursing students at the Battambang Regional Training Center (BTB RTC).

Materials & Methods: A descriptive cross-sectional study was carried out on September 6, 2024, among third-year nursing students at Battambang RTC. Data were collected via an online survey assessing socio-demographics, student self-efficacy (10 items), self-awareness (14 items), the clinical learning environment (33 items), and clinical competency (25 items). Data analysis was performed using SPSS version 29.0. Descriptive and inferential statistics, including Pearson correlation and multiple linear regression, were used to address the research questions.

Results: The majority of students were female (81.13%). The total mean clinical competency score was 3.48 ± 0.47, indicating a high level of competence. Pearson's correlation analysis indicated that self-efficacy, self-awareness, and the clinical learning environment were each positively and significantly associated with clinical competency. Furthermore, multiple linear regression identified the clinical learning environment ($\beta = 0.57$, $p < 0.001$), student self-efficacy ($\beta = 0.22$, $p = 0.019$), and gender ($\beta = -0.28$, $p < 0.001$) as significant determinants, collectively accounting for 59.40% of the variance in clinical competency.

Conclusion: Self-efficacy, self-awareness, the clinical learning environment, and gender are crucial factors for clinical competence in nursing students. Schools should promptly implement competency-based education programs to build students' confidence and self-awareness. Future studies should include multiple institutions and examine mediating factors to further improve clinical competency..

Keywords: clinical competence; students, nursing; learning environment

Introduction

Nursing education is a global strategy for producing competent nurses for effective healthcare practices. Quality nursing education can equip not only clinical competency, but also practical skills, ethical practice and self-awareness in response to a dynamic nursing landscape and diverse patient needs. However, recent literature found that students' clinical competency does not meet global standards for effective healthcare system. For example, many nurse students did not have appropriate attitudes and adequate confidence for delivering healthcare services to patients [1]. This research evidence suggests the importance of integrating hands-on, experiential learning into nursing education that can mediate the effect of training on developing clinical competency. Additionally, nursing education should include systemic environments and internal

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psychological factors that help shape professional skill levels to students. Another study suggested that nurse schools or institutions should offer educational programs that better prepare proactive workforce for real-world healthcare challenges [2].

In producing proactive nursing workforce, nursing education needs to articulate knowledge, technical skills, and clinical judgment essential for delivering high-quality patient care across diverse healthcare environments. Promoting resilient workforce in the context of public health also requires a robust level of clinical competency to diagnose influencing factors and assess current status of these specialized skills [3], which are key drivers to develop practical care competency of nurse students. However, the academic performance has emerged as a particularly significant indicator in predicting patient safety outcomes. This finding suggests that a student's capability to translate classroom theory into practice is a core component of their overall professional readiness [4]. Throughout the progression of their clinical training, nursing students are expected to cultivate essential professional attributes, including ethical reasoning, adherence to non-maleficence protocols, and a steadfast commitment to the profession [5]. Furthermore, the integration of evolving case-based simulations can foster the development of critical problem-solving abilities, effectively preparing nursing students to manage high-frequency clinical emergencies [6].

Addressing these specific influences is the only way to develop the kind of educational interventions that result in better-prepared nurses and safer patients. The World Health Organization's (WHO) eight pillars provide a roadmap for this training, ensuring that competency isn't just about grades, but a psychological balance of knowledge, empathy, and technical ability concepts rooted in Bloom's Taxonomy [7]. This multi-dimensional expertise has become a matter of global necessity which given that the COVID-19 crisis exposed deep vulnerabilities in healthcare systems [8]. The effectiveness of the clinical setting and the utilization of simulation-based learning are fundamental to shaping a student's professional proficiency. By facilitating the transition from classroom theory to hands-on application, simulation provides a controlled environment where students can sharpen the analytical and diagnostic skills necessary for nursing practice [9]. Competency-based education has gained recognition for its ability to equip graduates with the necessary skills for real-world practice settings [10]. Clinical competency requires skill acquisition and the development of the knowledge, attitudes, values, and professional behaviors outlined by nurses [11]. The literature also suggests that evaluating clinical competency is still a difficult and continuous task. Effective assessment tools are necessary to ensure that nursing students are adequately prepared for the rigor of clinical practice.

Nursing clinical competence is a key component that contributes to the quality of patient care and safety in healthcare systems. Nursing education in several developing countries, such as Cambodia, is undergoing major changes towards Competency-Based Education (CBE), designed to prepare health professionals with the necessary skills and competencies required for new emerging roles for health workforce [12]. Yet, competency-based training is still in its early stages and major challenges for success which include the resource constraints; absence of research on effectiveness; variable standards between training programs. As Cambodia moves towards CBE, it would be important to identify how far specific factors from both model's impact on clinical competencies for nursing students within localized settings such as the Battambang Regional Training Center which constitutes the main institution of nursing education in the western part of Cambodia.

Although international studies have investigated the determinants of clinical competence among nursing students, there is little research regarding specific culture and context in nursing education in Cambodia. The previous studies that have been conducted in Western and certain Asian countries have highlighted the importance of clinical learning environments, self-efficacy and socio-demographic factors (gender, family income) for the acquisition of clinical competence [13–15]. However, these results may not necessarily be generalizable to Cambodia as nursing students there are often confronted with different educational obstacles such as poor resources, insufficient practice and supervision, and diverse socio-economic status which can possibly affect their performance in delivering healthcare services, particularly in the changing healthcare system.

A lack of empirical studies on nursing education also fails to inform policymakers and stakeholders in producing a well-prepared nursing workforce that can meet the expanding health needs of its growing population in rural Cambodia. In addition, the limited research attention to improve nursing education fails to transform its nursing education model towards CBE that

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equip students with competence and skills for the changing healthcare context. The lack of research in nursing education has caused uncertainty to teachers and students in responding to obstacles they may encounter while executing healthcare services [16]. The implementation of CBE in Cambodian nursing schools, supported by external assistance, is currently under investigation for its effectiveness in enhancing students' clinical competencies.

However, the purpose of this study is to identify key factors affecting clinical training and the development of clinical competence, confidence and awareness among nursing students in Cambodian nursing education context.

The Battambang Regional Training Center hosts 188 nursing students ranging from high to low socio-economic status, offering an opportunity to explore such differences.

Knowledge of what influences the clinical competence of students in this institution would provide useful information to improve nursing education locally and add to the literature on CBE within a low-income college. However, much less is known about the impact of self-efficacy, clinical learning environment and/or socio-demographic variables on nursing students' competency in the context of Battambang Regional Training Centre. This represents a gap that needs to be filled through the identification and analysis of these determinants to inform development of nursing education strategies in Cambodi.

Materials & Methods

Design and setting(s)

A descriptive cross-sectional study was conducted to examine the influence of various factors on nursing students' clinical competency. This design allowed the simultaneous assessment of both the outcome (competency levels) and various potential influencers (such as socio-demographics, clinical learning environment, self-efficacy and self-awareness) at a single point in time.

This study was carried out in the Battambang Regional Training Center (BTB RTC), a leading school for nursing education in western Cambodia. This site was selected due to a highly diverse student demographic, which provided an ideal environment for investigating the determinants of clinical competency within a resource-constrained setting. Furthermore, as a primary nursing institution in the region, BTB RTC maintains a critical mandate to cultivate a substantial portion of the national nursing workforce. Data collection was conducted on September 6, 2024.

Participants and sampling

The present study focused on third-year nursing students who were studying in the Battambang Regional Training Center in Cambodia. The students were selected using a convenience sampling approach. A prior power analysis was conducted based on G* Power 3.1 to determine the minimum required sample size for examining the association between a dichotomous variable and a continuous variable using the point biserial correlation model within the t-test family.

The following parameters were specified: effect size $|\rho| = 0.30$, significance level (α) = 0.05, and desired statistical power ($1-\beta$) of 0.95. Analysis was one-tailed, reflecting the directional hypothesis. The results indicated that a total sample size of 111 participants is required to achieve a power of 0.95, given these parameters.

Tools/Instruments

A standardized questionnaire was used in this study. The students' demographic section gathered information on the following topics: average family income, work experience, the availability of a preceptor during the internship, gender (1 = male and 2 = female), age, and accommodation during the study. Data for this research were gathered through standard forms that were prepared specifically to assess the main components of clinical competence in nursing students. The original measurement tools included Student Self-Efficacy (10 items, $\alpha = 0.84$); Nursing Students' Rights Awareness (14 items, $\alpha = 0.92$); the Clinical Learning Environment Scale (CLES) (34 items, $\alpha = 0.93$); and the Clinical Competency Scale (30 items, $\alpha = 0.98$) [17–20]. The aggregated ratings procedure using a Likert scale was used by experts to represent the attitude of people [21]. All tools utilized a 5-point Likert scale and were adapted from established nursing education and clinical competency scales to fit the Cambodian nursing education context [22, 23].

Content validity was established by a panel of 10 experts from BTB RTC, BTB PRH, and the University of Health Sciences (**Table 1**). On the other hand, the reliability was confirmed via Cronbach's α coefficients based on the 106-participant sample (**Table 2**). The following section provides a streamlined summary of the instruments used in this study.

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Table 1. Content validity index results for research instruments (n = 10)

Instrument	Original Items	Final Items	I-CVI Range	Mean I-CVI ± SD	S-CVI/Ave	S-CVI/UA
Student self-efficacy	10	10	0.90–1.00	0.96 ± 0.03	0.96	0.90
Student self-awareness	14	14	0.90–1.00	0.95 ± 0.03	0.95	0.86
Clinical learning environment	34	33	0.60–1.00	0.91 ± 0.11	0.94	0.82*
Clinical competency	30	25	0.70–1.00	0.89 ± 0.12	0.93	0.80**

Note: Acceptable thresholds for content validity indices were I-CVI ≥ 0.78 for 6–10 experts and S-CVI/Ave ≥ 0.90 (Polit & Beck, 2006). One item was removed from the Clinical learning environment scale ("The meetings between myself, mentor and nurse teacher were comfortable experience", I-CVI = 0.60) because it measured two distinct constructs. Five items were removed from the Clinical competency scale (the "global vision" dimension, I-CVI range 0.70–0.80) because they focused on general knowledge rather than context-specific competency-based skills.
Abbreviations: I-CVI, item-level content validity index; S-CVI/Ave, scale-level content validity index/average calculation method; S-CVI/UA, scale-level content validity index/universal agreement method; SD, standard deviation.

Table 2. Instrument's reliability coefficient (n = 106)

Instrument	Number of items	Cronbach's α
Student self-awareness	14	0.89
Student self-efficacy	10	0.86
Clinical learning environment	33	0.95
Clinical competency	25	0.94

Note: Cronbach's alpha was used to assess the internal consistency of the instruments.
Abbreviations: n, sample size.

Student self-efficacy: The 10-item instrument measures student confidence in clinical settings. The scale demonstrated exceptional validity with a Scale-Content Validity Index/Average (S-CVI/AVE) of 0.96 and a Scale-Content Validity Index/Universal Agreement (S-CVI/UA) of 0.90. Every original item was retained as Item-Content Validity Index (I-CVI) values remained high (0.90–1.00). The scale also showed strong internal consistency with a Cronbach's alpha of 0.86.

Student self-awareness: The Student Self-Awareness Scale consists of 14 items. Experts rated 0.95 for S-CVI/AVE and 0.86 for S-CVI/UA, which means that all items met the standard for retention. Reliability testing was at Cronbach's α of 0.89, which means the tools were internally consistent measures.

Clinical learning environment: The scale initially consisted of 34 items. During the validation phase, one item "Meetings between students and mentors" was removed due to a low I-CVI (0.60). The final 33-item version achieved an S-CVI/AVE of 0.94 and excellent reliability with a Cronbach's α of 0.95.

Clinical competency: This tool was refined from an original 30-item pool. Five items from the 'global vision' sub-scale (with I-CVIs as low as 0.70) were removed because the theoretical content did not correspond to practical care in Cambodia. Thus, the final 25-item version reached an S-CVI/AVE of 0.93 and demonstrated the highest internal consistency among sub-constructs (α = 0.94).

Following the initial validation, the scale was further refined through expert qualitative input to improve accessibility for students, with the aim of enhancing readability while preserving the integrity of the conceptual framework. Because all scales achieved S-CVI/AVE values exceeding the 0.90 threshold, the instruments can be considered highly relevant for measuring nursing constructs in Cambodia. Furthermore, the deliberate removal of six items that failed to meet performance standards helped strengthen the overall model, ensuring a more culturally precise evaluation of student competency.

Data collection methods

The questionnaires were administered to the nursing students using Google Form to collect data on their clinical experiences and educational background. To avoid missing data, the researchers set a requirement for each item to be completed before submission. Additionally, reminders were sent to participants who had not yet completed the questionnaire to ensure a high response rate.

Data analysis

Data were analyzed using the Statistical Package for the Social Sciences (SPSS) version 29.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics (frequency, percentage, mean, standard deviation) summarized demographic and study variables. Based on the psychometric testing scores perceived by nursing students ranging from 1 to 5, the mean score was divided into five levels using the class interval formula. Moreover, to prevent the intervals from overlapping, 0.01 was added to each successive lower limit [24]. The interpretations of ranges of mean scores ranging from

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4.21 to 5.00 and 3.41 to 4.20 are interpreted as the highest level. Scores between 2.61 and 3.40 indicate a moderate level, while scores from 1.81 to 2.60 reflect a low level. Finally, scores between 1.00 and 1.80 are considered the lowest level of interpretation. Inferential statistics, including Pearson's product-moment correlation coefficient and multiple linear regression, assessed relationships among study variables and identified the potential influencing variables. The significance level was set at $p < 0.05$.

Results

The present study identifies key factors that influence nursing education in a single training center. Data collected from 106 nursing students showed different gender ratios, as the responses from female students were dominant, accounting for 81.13%. On average, the students were 21.43 years old, ranging from 21 to 34. The result indicated that most students were young adults who were potential candidates for engaging with healthcare services.

The nursing students had socioeconomic differences; the majority (81.13%) reported average family income earnings below 300 USD, while only a negligible fraction (0.94%) earned more than 1,000 USD. Despite these financial hurdles, intrinsic motivation remained the dominant driver for entering the profession, with 88.70% of students having self-selected their field of study. Furthermore, the high prevalence of rented accommodation (78.30%) suggests that the majority of students face the dual burdens of relocation and increased living expenses (**Table 3**).

Table 3. Demographic and background characteristics of nursing students (n = 106)

Variables	n	%
Gender		
Male	20	18.87
Female	86	81.13
Age (years)		
Mean ± SD	21.43 ± 3.45	
Range	21–34	
Work experience		
Student	104	98.11
Nursing staff who continue to study	2	1.89
Preceptor availability during the internship		
Yes	105	99.10
No	1	0.90
Average Family Income		
Less than 1.2 million Riels (US $300)	86	81.13
From 1.2 million Riels (US $300) to 4 million Riels (US $1,000)	19	17.93
From 4 million Riels (US $1,000) and up	1	0.94
Factors to choose the nursing field		
Self-choice	94	88.70
Parents	11	10.40
Friends	0	0.00
Do not know	1	0.90
Types of stay during the study		
Home	12	11.30
School dormitory	0	0.00
Relative house	9	8.50
Rental house	83	78.30
Other	2	1.90

Note: Descriptive statistics were used to summarize demographic data. Percentages may not total 100 due to rounding. The standard deviation for age was not provided in the original text; please verify the value "3.45" with the actual data.
Abbreviations: n, number of participants; SD, standard deviation; US$, United States Dollar.

The students who participated in the study agreed that they had a high level of clinical competency since the overall mean of these items was at 3.48. The students' assessment of their clinical competency was not far different since the standard deviation was only 0.47. "Within the sub-domain of medical-related knowledge (mean 3.15 ± 0.62), students demonstrated the greatest proficiency in identifying common diseases. Basic nursing skills were rated at a mean of 3.47 ± 0.55, which indicated that students could provide proper skills. Additionally, communication and cooperation had a mean score of 3.70 ± 0.56. Students were able to engage patients' family members and other professionals to improve patients' outcomes. On the other hand, life-long learning had a mean score of 3.59 ± 0.54. This score suggested that students might recognize the importance

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of continuous career development after graduation. Last, critical thinking received a mean score of 3.48 ± 0.52. The independent ability proceeds with analytic reasoning and hands-on tasks in clinical practice (**Table 4**).

Table 4. Distribution of clinical competency scores across sub-domains

Sub-domains	Mean ± SD
Medical related knowledge	3.15 ± 0.62
Basic nursing skills	3.47 ± 0.55
Communication and cooperation	3.70 ± 0.56
Life long learning	3.59 ± 0.54
Critical thinking	3.48 ± 0.52
Overall score	3.48 ± 0.47

Note: Descriptive statistics were used to summarize the scores. Higher mean values indicate stronger perceived competency in each domain. The overall clinical competency score reflects the aggregated performance across all sub-domains.
Abbreviations: SD, standard deviation.

Pearson's product-moment correlation was employed to examine the associations between demographic variables and clinical competency. The analysis revealed that the clinical learning environment shared the most robust relationship with competency ($r = 0.68$, $p < 0.01$), showing the importance of a high-quality clinical setting. Additionally, significant positive correlations were found for student self-efficacy ($r = 0.50$, $p < 0.01$) and self-awareness ($r = 0.40$, $p < 0.01$), suggesting that psychological readiness and self-reflection are key drivers of performance.

Conversely, gender showed a significant negative correlation ($r = -0.24$, $p < 0.05$).

This pointed out that gender may influence clinical competency. Other demographic factors such as age, income, and study choice did not demonstrate meaningful associations with clinical competency, highlighting that background characteristics are less influential than psychological and environmental factors (**Table 5**).

Table 5. Descriptive statistics and associations between independent variables and clinical competency

Variables	Mean ± SD	1	2	3	4	5	6	7	8
1. Gender	1.81 ± 0.39	—							
2. Age	21.43 ± 2.16	-0.25*	—						
3. Income	1.20 ± 0.42	-0.23*	0.00	—					
4. Study choice	2.03 ± 9.51	0.00	0.00	0.00	—				
5. Self-efficacy	3.66 ± 0.51	0.00	0.00	-0.24*	-0.21*	—			
6. Self-awareness	4.04 ± 0.48	0.00	0.00	0.00	0.00	0.45**	—		
7. Clinical learning environment	3.70 ± 0.44	0.00	0.00	0.00	0.00	0.45**	0.48**	—	
8. Clinical competency	3.48 ± 0.47	-0.24*	0.00	0.00	0.00	0.50**	0.40**	0.68**	—

Note: Gender was coded as 1 = Male, 2 = Female. Values represent Pearson correlation coefficients between variables. *p < 0.05, **p < 0.01. Non-significant correlations are reported as 0.00.
Abbreviations: SD, standard deviation.

The final model in the hierarchical multiple regression analysis (Model 4) was statistically significant and accounted for 59.40% of the variance in the outcome variable ($R^2 = 0.59$, Adjusted $R^2 = 0.57$). The regression constant for this model was 0.50, though it was not statistically significant ($p = 0.225$), indicating that the intercept did not differ significantly from zero when all factors were held at their baseline. Of all the factors analyzed, the CLE proved to be the most influential driver of success. High quality in the clinical setting was fundamental to increase clinical competency with an unstandardized coefficient of 0.66 and a standardized beta of 0.57 ($p < 0.001$). Student Self-Efficacy (SSE) also emerged as a significant correlation factor to clinical competency ($B = 0.20$, $\beta = 0.22$, $p = 0.019$). This positive relationship suggested that as nursing students' confidence in their professional capabilities increases, there is a corresponding improvement in their clinical competency.

Conversely, gender was found to be a significant negative factor ($B = -0.32$, $\beta = -0.28$, $p < 0.001$), which implied females had significantly lower results on the outcome variable compared to the reference group. Finally, student self-awareness (SSA) did not make a significant contribution to the model's explanatory power ($B = 0.09$, $\beta = 0.09$, $p = 0.340$), as its p-value exceeded the standard 0.05 threshold (**Table 6**).

Overall findings demonstrate that a supportive clinical learning environment, elevated levels of self-efficacy, and gender variations are all explanatory factors of clinical competency.

Among these factors, the quality of the clinical learning environment emerged as the most influential determinant of student proficiency.

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Table 6. Multiple linear regression modeling of clinical competency predictors

Independent variables	B	SE	β	t	p	R^2	Adjusted R^2
Model 1						0.48	0.48
(Constant)	0.47	0.38		1.24	0.220		
CLE	0.81	0.10	0.70	8.05	< 0.001		
Model 2						0.52	0.50
(Constant)	0.23	0.39		0.59	0.560		
CLE	0.70	0.11	0.60	6.35	< 0.001		
SSE	0.18	0.08	0.21	2.18	0.032		
Model 3						0.52	0.50
(Constant)	0.14	0.43		0.32	0.748		
CLE	0.68	0.18	0.59	5.85	< 0.001		
SSE	0.17	0.09	0.19	1.92	0.059		
SSA	0.05	0.10	0.05	0.51	0.615		
Model 4						0.59	0.57
(Constant)	0.50	0.41		1.22	0.225		
CLE	0.66	0.11	0.57	6.12	< 0.001		
SSE	0.20	0.08	0.22	2.41	0.019		
SSA	0.09	0.09	0.09	0.96	0.340		
Gender	-0.32	0.09	-0.28	-3.46	< 0.001		

Note: Multiple linear regression analysis was performed to identify predictors of clinical competency.
Abbreviations: B, unstandardized coefficient; SE, standard error; β, standardized coefficient; CLE, clinical learning environment; SSE, student self-efficacy; SSA, student self-awareness; R^2, coefficient of determination.

Discussion

The findings of this study offered a deeper understanding of the key factors that shape clinical proficiency in nursing students. The results indicated that clinical competency was significantly correlated with the CLE, SSE, and gender.

Conversely, no significant association was observed between SSA and clinical competency. The current model demonstrated an explanatory power of 59.40%, significantly exceeding previous frameworks that focused on self-directed learning (20.50%) [25] or internal psychological traits like stress (39.40%) [26]. This suggested that in the Cambodian nursing context, external structural factors and internal confidence were the dominant drivers of competence. Although the final sample (n = 106) fell slightly below the initial target of 111, a post-hoc power analysis confirmed that the study remained statistically robust. The model explained 59.40% of the variance, representing a large effect size ($f2 = 1.46$). Consequently, the analysis achieved a statistical power level above 0.99 ($\alpha = 0.05$). Thus, the sample proved highly sensitive and sufficient for identifying significant independent variables.

CLE and self-efficacy were found to be critical variables influencing clinical competency. This aligned with previous studies, yet it calls attention to a more nuanced explanation for the Cambodian context. In an environment where resources are limited and access to high-quality training is inconsistent, a well-managed and supportive CLE becomes the primary venue for skill acquisition. The strong association between the CLE and clinical competence found in this study ($r = 0.68$, $p < 0.01$) was in line with large international studies. The CLE offers increased active learning, real-time feedback, and quality patient care, all adding value to the acquisition of clinical skills [27]. Professional interest, self-efficacy, and the clinical learning environment have been reported as variables that significantly predict clinical competence, accounting for 36.10% of the variance in the construct [15]. For instance, a multicenter study with 1,746 European nursing students concluded that a positive appreciation of the clinical learning environment makes an essential contribution to increased levels of nursing competence [14]. The learning experience closes the gap between classroom education and real-world clinical practice, reinforcing competencies required for patient care. Thus, strengthening the CLE should be a key agenda in nursing education, including in low-resource countries such as Cambodia. Self-efficacy proved to be a strong determinant of clinical ability; increased belief in oneself seemed to carry over into a greater capacity for professional attainment. In collectivist societies that prioritize conformity and authority, students may struggle to build self-efficacy without opportunities for active participation or leadership in clinical settings. This finding was consistent with studies conducted at Isfahan University of Medical Sciences, Iran; Pennsylvania, USA; and Lebanon and Saudi Arabia, which showed that self-efficacy was a significant predictor of a student's clinical performance, and clinical competence was also related to high clinical self-efficacy [27–29]. This

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underscored that self-efficacy is a universal psychological construct in professional education, specifically in nursing. A research study in Indonesia found a significant correlation between nursing students' self-efficacy scores and their competency scores in terms of evidence-based practices [30]. Self-confidence was not just tied to technical skills but also to the cognitive application of knowledge and critical thinking for best practices. However, there was a suggestion that nursing students' clinical competence was correlated with their self-efficacy, and this relationship led to improved student clinical performance [31]. A positive feedback network could lead students to perform better, which in turn engages self-belief and continuous improvement. In addition, the result agreed with the study which suggests that a student's belief in their ability to learn (learning self-efficacy) is a strong determinant of their clinical skills and professional success [32]. Additionally, these results supported Bandura's social cognitive theory regarding the contingency belief that self-efficacy and learning outcomes are shaped by the social environment [33]. On the other hand, these results could be explained by Vygotsky's sociocultural theory, which claims that learning takes place via social interactions in a culturally and contextually situated setting [34]. This research emphasized that providing proper tools and social exchange opportunities was vital for developing competence. Additionally, the findings supported integrating environmental, psychological, and socio-demographic factors into nursing education curricula.

The identification of gender variation in clinician proficiency was a notable finding. Male students had lower scores for clinical competency than their female counterparts.

This result was opposite to the trend internationally, which usually shows that female student nurses have better clinical ability. The present investigation revealed an inverse relationship between gender and clinical competence [35].

In the Cambodian context, male nursing students might face societal expectations to adhere as closely as possible to traditional gender roles, which means shunning "feminine" professions like nursing. Conversely, female students may experience gender stereotypes in clinical settings where their competence tends to be devalued, conditioning a decrease in self-efficacy. The interaction of these socio-cultural norms might explain why male students in the present study have lower clinical competence scores. On the other hand, gender remained a significant determinant of clinical competency, aligning with earlier results. A study in a tertiary institution in Nigeria demonstrated that gender was a significant predictor of competence, with female nursing students exhibiting a higher level of clinical competence [36]. In Cambodia, male and female nursing students often do not have access to the same opportunities due to gender roles. For instance, women might face cultural norms that constrain their involvement in physically strenuous or leadership clinical environments. Relatedly, female students may have less perceived self-efficacy than male students, as well as in performing clinical skills. Both self-efficacy and personal perceptions could be influenced by social norms, particularly in gender-constrained environments [28]. These results underscored the importance of future study on gender and clinical competency, particularly within culturally constrained environments such as Cambodia.

SSA was not a significant determinant of clinical competency in the current study. While some research indicates that nursing competencies are enhanced through self-reflection programs that improve self-awareness [37], this suggested a potential 'threshold effect' in the Cambodian context. Specifically, while awareness and stress reduction were beneficial for a student's personal well-being, they might not translate into measurable clinical skills. While Miller characterized self-awareness as a prerequisite for professional decision-making, the current study offers a contrasting perspective within the Cambodian nursing context [38].

The finding of this study demonstrated that self-awareness did not act as a significant determinant of clinical competency, suggesting that in high-pressure, resource-limited environments, internal insight remains a latent attribute. Drawing from Objective Self-Awareness (OSA) theory, the non-significant role of SSA in this model suggested that internal reflection alone was insufficient for behavioral change. Self-awareness acted as a catalyst for better performance only when individuals could manage their current state to align with established benchmarks of accuracy [39]. This suggested that without a clear "standard of correctness," self-reflection alone may not be sufficient to enhance technical performance.

The findings of the present study implied that educational institutions should provide clinical supervision with quality, qualified preceptors, and competency-based education adaptation to improve student outcomes. Furthermore, an organized structure could empower learners to enhance competence through

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inquisitive skills with direct hands-on practice. The findings also highlighted the importance of addressing gender-based differences within the Cambodian context. Socio-cultural expectations and professional preconceptions could be barriers to student success. It is essential for educational institutions to design targeted interventions that include gender-specific mentorship and leadership pathways as additional programs. Moreover, the integration of Bandura's and Vygotsky's social learning theories offered a deeper understanding of the dynamic interaction between internal psychological factors (e.g., self-efficacy) and external environmental factors in shaping clinical development. Ultimately, creating inclusive strategies that respond to diverse contexts is essential for increasing clinical competencies for all students. Regarding the study limitations, the final sample of 106 participants fell slightly short of the initial power calculation target of 111. While the statistically significant relationships for the Clinical Learning Environment and Student Self-Efficacy suggest the sample remained robust, the descriptive cross-sectional design makes it difficult to infer causal relationships. Furthermore, self-reported data may introduce response bias, specifically social desirability bias. This clarifies that the results reflect perceived levels of competence and highlights the value of including objective assessments in future research.

zWhile the localized convenience sampling at the Battambang Regional Training Centre limits generalizability, the findings provide a useful framework for other regional nursing programs in Cambodia and similar Southeast Asian contexts. Future research should include random sampling across multi-center settings to strengthen external validity and provide a more comprehensive understanding of the determinant factors of clinical competency.

Conclusion

This study provides a robust explanatory framework for clinical competency among nursing students. The findings indicated that the CLE, student self-efficacy, and gender explained 59.40% of the observed variance. In the Cambodian context, external structural support and professional confidence emerge as more decisive drivers of competence than internal self-awareness. Specifically, the lack of significance for SSA suggests that while reflection is a valuable trait, it remains a latent skill. Reflection does not directly translate into clinical proficiency without a supportive environmental structure and a strong sense of self-belief. Consequently, educational programs should prioritize the development of the CLE through better-resourced placements and mentorship to provide constructive and actionable feedback. Furthermore, integrating gender-sensitive interventions and self-efficacy building strategies (e.g., simulation-based learning and mastery-focused classroom environments) is essential to bridge the gap between theory and practice. Ultimately, these results highlight the need for a culturally responsive curriculum that aligns with local socio-cultural norms and actual resources. Educational institutions should qualify graduates with the necessary resilience and skills for professional practice in resource-limited spaces by prioritizing key environmental and psychological factors.

Ethical considerations

The study was approved by the National Ethics Committee for Health Research (No. 221 NECHR). Participants were informed that the research posed no risks and would not affect their health. The study began after all participants provided written consent to participate. Completed questionnaires were placed in a designated return box in each department for collection by the research assistant.

Artificial intelligence utilization for article writing

No Artificial Intelligence (AI) tools were used in the writing or preparation of this manuscript.

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Conflict of interest statement

The authors declare no conflicts of interest.

Author contributions

BY, VK, and RS conceived and designed this study, while CH helped with the critical revision of the article. BY and VK also performed the data analysis and interpretation. All authors have read and approved the manuscript.

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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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