



An Educational Model for Developing Clinical Competency among Undergraduate Nursing Students: A Structural Equation Modeling Study

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Received 12/07/2026

Revised 12/08/2026

Accepted 10/09/2026

Abstract

Background and Aim: Contemporary healthcare requires nursing graduates capable of delivering safe, high-quality patient care. Understanding how personal, academic, instructional, and clinical-environment factors influence nursing students' clinical skills is essential. This study examined the relationships between these factors and clinical competency development.

Materials and Methods: A descriptive-correlational, causal-comparative design incorporating structural equation modeling (SEM) was employed. Participants were 598 nursing students from three private higher education institutions in Iligan City, Philippines. Data were collected using a pilot-tested, validated researcher-developed questionnaire. Pearson correlation, multiple regression, confirmatory factor analysis (CFA), and SEM were performed using SPSS 29 and AMOS 29, with significance established at $p < .05$.

Results: All predictor domains significantly influenced clinical skills development. The clinical environment demonstrated the strongest correlation with clinical skills ($r = .747, p < .001$). In multiple regression analysis, assessment emerged as the strongest predictor ($\beta = .350$), while the model explained 63.4% of the variance in clinical skills development ($R^2 = .634$). SEM identified the clinical environment as having the largest direct effect ($\beta = .562$). The model demonstrated good fit (CFI = .996; RMSEA = .032).

Conclusion: The findings support the Apal Clinical Competency Development Model (ACCDM) as an integrated framework for explaining nursing students' clinical skills development. The model provides a basis for evidence-informed curriculum redesign, competency-based assessment, simulation, digital learning, initiatives strengthening student self-efficacy, and improvements in clinical instruction. Its application may help nursing institutions create supportive learning environments and prepare graduates to meet standards for safe, competent, high-quality professional practice.

Keywords: Experiential Learning, Competency-Based Education, Practice Readiness, Clinical Immersion, Professional Formation

Introduction

Clinical proficiency is a fundamental result of nursing education since it directly influences nurses' ability to deliver safe, ethical, and superior patient care. Modern nursing practice necessitates that graduates amalgamate theoretical understanding, clinical reasoning, psychomotor abilities, analytical thinking, communication skills, and professional assurance when addressing progressively intricate healthcare scenarios. Apprehensions about the preparedness of newly licensed nurses have consequently established both a strategic and ethical need for nursing education institutions to enhance competency development and evaluation (Kavanagh & Sharpnack, 2021). The pressures faced by nurses in significant health crises have underscored the necessity of equipping graduates with the ability to adapt, make judicious clinical choices, and provide safe care in high-stress situations (Al Thobaity & Alshammari, 2020).

In the Philippines, the national policies and standards set for the Bachelor of Science in Nursing program endorse competency-based nursing education. The updated regulations of the Commission on Higher Education prioritize the enhancement of professional skills, the amalgamation of theoretical and practical education, and the training of graduates capable of delivering safe, compassionate, and evidence-informed nursing care (Commission on Higher Education, 2017). Nonetheless, converting curricular norms into uniform clinical execution continues to pose difficulties. Nursing students could have sufficient theoretical understanding yet struggle to independently implement that knowledge in intricate and unpredictable clinical scenarios. This persistent disparity between theory and practice highlights the necessity for curricula, teaching methodologies, evaluation frameworks, and clinical collaborations that cultivate competence incrementally instead of viewing it as a result that arises spontaneously from finishing courses or clinical experiences.





Clinical proficiency evolves through the interplay of individual, educational, pedagogical, and clinical-contextual elements. On an individual basis, self-efficacy affects students' strategies for tackling challenging clinical assignments, maintaining perseverance, and assessing their ability to fulfill nursing duties (Bandura, 2006). Enhanced self-efficacy among nursing students correlates with improved learning experiences and the advancement of clinical proficiency (Arribas-Marín et al., 2024; Shorey et al., 2023). Resilience, adaptive capacity, and social support are crucial as nursing students often face academic stress, emotional challenges, and anxiety during clinical training and transition (Berdida & Grande, 2023; Labrague et al., 2021; Warshawski, 2022). On the other hand, extended stress and academic fatigue can jeopardize students' mental health and their capacity to engage effectively in clinical education (Ortiz et al., 2024; Ridad et al., 2024).

Scholarly preparation furnishes the theoretical and empirical bases essential for clinical thinking and decision-making. Nonetheless, knowledge attains instructional significance when learners can utilize it in patient evaluation, care strategy formulation, intervention, and assessment. Establishing constructive alignment among desired abilities, educational activities, and evaluations is essential to guarantee that classroom teaching equips students for real clinical duties (Biggs & Tang, 2022). Experiential learning underscores that proficiency is cultivated through iterative processes of tangible experience, contemplation, theoretical comprehension, and practical implementation (Kolb, 1984; Yardley et al., 2012). Consequently, nursing programs should offer students multiple chances to integrate theoretical knowledge with practical clinical challenges.

Instructional methodologies also affect the efficacy with which pupils convert knowledge into clinical execution. Simulation-oriented education enables learners to refine technical and decision-making competencies in a regulated setting, thereby safeguarding patients from undue risk. Comprehensive and cohesive data suggest that simulation enhances the acquisition of clinical skills, self-assurance, decision-making, and readiness when paired with explicit learning goals and organized reflection (Cant & Cooper, 2017; Koukourikos et al., 2021). Meticulously crafted simulation scenarios might enhance students' clinical reasoning by necessitating the interpretation of patient data, prioritization of interventions, and contemplation of their choices (Uppor et al., 2023). In a similar vein, blended, contextual, and technology-enhanced learning methodologies could foster critical thinking, self-efficacy, clinical involvement, and skill development (Chang et al., 2022; Nguyen et al., 2023).

The caliber of the therapeutic learning environment holds similar significance. Students enhance their skills more efficiently when clinical placements offer appropriate oversight, constructive criticism, ample learning experiences, nurturing interpersonal connections, and access to suitable resources (Chan et al., 2023; Flott & Linden, 2022). A feeling of inclusion during clinical placements can motivate students to engage, inquire, and request help, while unwelcoming settings may hinder learning and diminish self-assurance (Levett-Jones et al., 2022). Clinical educators and supervisors act as exemplary professionals whose mentorship can enhance students' self-efficacy and professional identity (Henderson et al., 2021; Rodríguez-García et al., 2022). Thus, clinical competence ought not to be perceived merely as a personal characteristic of the learner; it is equally a product of the educational and organizational contexts in which the learning transpires.

Research indicates that the proficiency of nursing students is influenced by various interconnected factors rather than solely by one educational element (Kaihlanen et al., 2023; Sulosaari et al., 2022). Individual self-assurance might influence students' eagerness to engage in clinical tasks, whilst pedagogical assistance could bolster confidence and enhance the utilization of scholarly information. In a similar vein, the impact of simulation or classroom readiness may be contingent upon the caliber of oversight and educational prospects present during clinical assignments. Research that investigates these areas in isolation may consequently neglect the direct and indirect routes via which individual traits and educational circumstances together affect clinical proficiency.

The current research is in accordance with the United Nations Sustainable Development Goals (SDGs). The research bolsters nursing students' ability to deliver safe and proficient care, thereby advancing SDG 3, which pertains to Good Health and Well-being. Its focus on competency-oriented curriculum development, evaluation, simulation, oversight, and inclusive clinical education supports SDG 4, Quality Education. The integration of simulation, digital education, and a rigorously validated pedagogical framework is especially pertinent to SDG 9, which focuses on Industry, Innovation, and





Infrastructure. This research regards these associations as specific educational and healthcare outcomes instead of general contextual assertions: competence, self-efficacy, instructional quality, clinical environment quality, simulation-assisted learning, and digital preparedness are analyzed as quantifiable elements of nursing education.

Prior research has explored the factors influencing nursing students' clinical proficiency; nevertheless, a significant portion of the existing studies has analyzed personal, academic, instructional, or environmental variables in isolation. Conventional correlational and regression methodologies are effective for assessing associations but may fall short in analyzing multiple concurrent correlations among observable indicators and latent dimensions. Structural equation modeling (SEM) is a suitable analytical method as it allows for the evaluation of theoretically defined direct and indirect connections within a cohesive framework (Hair et al., 2019; Kline, 2023). Nevertheless, there exists scant information concerning the application of SEM to elucidate nursing students' clinical proficiency in private higher education institutions in the Philippines.

To fill this void, the current research formulates and substantiates the Apal Clinical Competency Development Model (ACCDM). The concept encompasses four primary domains: individual characteristics, educational readiness, teaching elements, and the clinical training setting. Instead of considering these domains as independent predictors, the ACCDM investigates their interconnections at both the observed-variable and latent-construct tiers. The research aims to offer a contextually relevant elucidation of the evolution of clinical competence among nursing students in private higher education institutions in the Philippines. The results may guide curriculum evaluation, competency measurement, faculty enhancement, simulation and digital education approaches, clinical oversight, and institutional collaborations aimed at improving the shift from theoretical training to secure and assured nursing practice.

Objectives

This study aimed to: (1) measure the factors determining personal, contextual, instructional, academic, and clinical environment factors with the development of clinical skills among nursing students; (2) ascertain the relationship of the predictor domains to the development of clinical skills; (3) determine the significant observed-variable predictors of clinical skills development using multiple linear regression; (4) examine the measurement and structural relationships among the latent constructs with confirmatory factor analysis (CFA) and structural equation modeling (SEM); (5) formulate and assess the Apal Clinical Competency Development Model (ACCDM).

Literature Review

The Apal Clinical Competency Development Model (ACCDM) has been established on the integrated principles of Experiential Learning Theory, Social Learning Theory, and Benner's Novice-to-Expert Theory. These theories explain the developmental stages of clinical competency of nursing students as a result of the interplay among the individual attributes of the nursing students, the educational process, and the clinical teaching environment.

Experiential Learning Theory describes clinical competence as a cycle of concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). In the ACCDM, the theory outlines how students are provided with opportunities to experience, reflect, conceptualize, and ultimately improve and advance their nursing practice through the use of clinical simulations, practice in skills laboratories, and clinical practice.

Social Learning Theory describes the interactions of personal characteristics, behavior, and the environment as being reciprocal (Bandura, 2017). In the context of nursing education, clinical practice is driven by a student's self-efficacy, motivation, and emotional resilience. These can be bolstered by observing, modeling, and receiving feedback, as well as having educators who are supportive. In this regard, the theory provides the basis for the connection between personal aspects and the instructional and clinical environment aspects.

In Benner's Novice-to-Expert Theory, the idea of competence is the advancement of practice through the accumulation of experience and development of clinical judgment at distinct stages (Benner, 1984). In the ACCDM, the guided practice of clinical work, along with the opportunities for reflection and



repeated practice, are the elements that are anticipated to aid the transition from the novice practice of clinical work to the attainment of greater competence and proficiency.

Experiential Learning Theory, Social Learning Theory, and Benner's Novice-to-Expert Theory collectively provide an overview of the ACCDM. Competence is described as the result of experience and reflection in Social Learning Theory, and in Benner's Novice-to-Expert Theory, the gradual advancement of clinical competence occurs with practice that is structured. Thus, the theory as a whole offers the idea that the development of clinical skills is the result of personal willingness, preparation, degree of support provided in the classroom, and the real-world environment in which the learning occurs.

Conceptual Framework:

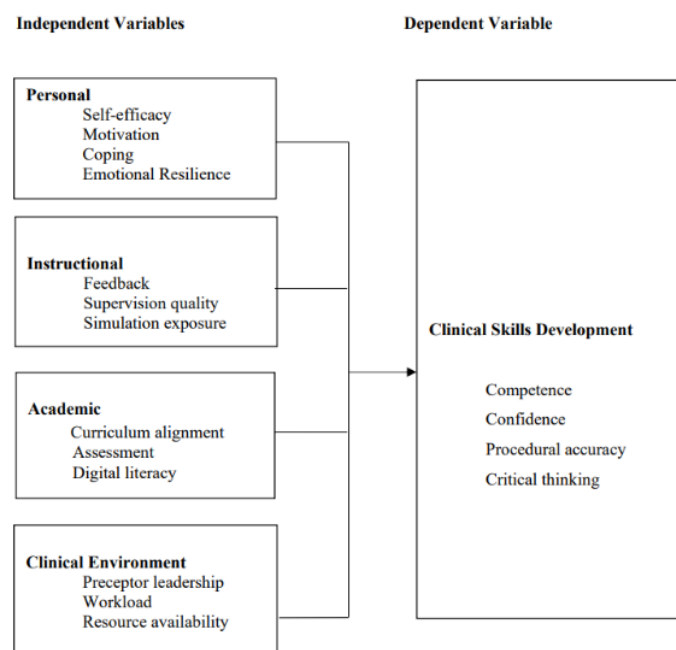


Figure 1. Schematic Presentation of the Interplay of Variables in the Study

Per the ACCDM, personal, academic, instructional, and clinical-environment factors help to describe the clinical skill development of undergraduate nursing students. The model is built upon the theories of Experiential Learning, Social Learning, and Benner's Novice-to-Expert, and accounts for the interconnections of learner attributes, educational system elements, and the contextual framework of clinical practice.

Clinical skill development is the highest-order construct. It comprises the elements of competence, confidence, and accuracy of a skill along with critical thinking. In relation to other factors, personal factors are presumed to impact students' levels of preparedness and engagement in learning. Academic factors are related to knowledge and reasoning. Instructional factors pertain to the provision of feedback, supervision, and different forms of instructional support that are more focused and tailored. The clinical contextual elements refer to opportunities, resources, different forms of workload, and leadership of a clinical teacher that enable students to practice and improve what they have learned.

The framework clearly demarcates the conceptual model from statistical procedures that are used to evaluate the model. Bivariate relationships are determined by the Pearson correlation coefficient. Multiple regression establishes the significant predictors among the observed variables. Structural equation modeling (SEM) assesses relationships and the structure of latent variables. This is critical for understanding the interrelatedness of the various fields.



Hypotheses

The null hypotheses were tested at a 0.05 level of significance.

H01: There is no significant relationship between Clinical Skills Development and Personal Factors, Instructional Factors, Academic Factors, and Clinical Environment Factors.

Ho2: There is no single or combined variable that best predicts the Clinical Skills Development of nursing students.

H03: There is no structural model that best fits the Clinical Skills Development of nursing students.

Methodology

Research Design

A non-experimental survey research design was used to focus on the factors associated with the clinical skills development of undergraduate nursing students. Study variables used descriptive statistics, Pearson correlation was used for examining bivariate relationships, and multiple linear regression was used for observed-variable prediction. Structural equation modeling was applied to assess the latent measurement and structural models.

Setting and Participants

The study was conducted from January to March 2026, in three private higher education institutions that provide the Bachelor of Science in Nursing program in Iligan City, Philippines. A total population survey sampling technique was used. Invited participants included all Level III and IV nursing students who had already been exposed to the essentials of professional nursing practice.

Inclusion and Exclusion Criteria

Participants in the study were Level III or IV nursing students who had completed at least one semester. From 612 eligible nursing students, 598 completed the questionnaire, a response rate of 97.7%. For the remaining 14 students, data from clinical duties outside the study's data collection zones were not included. The high response rate shows good coverage of the eligible nursing students from the study's participating institutions.

Research Instrument

While there are some validated tools, none fully address every dimension of the ACCDM. Consequently, a researcher-developed tool was designed to combine the personal, instructional, academic, clinical environment, and clinical skills development domains of the model.

For the measurement of constructs outlined in the Apal Clinical Competency Development Model (ACCDM), a researcher-designed questionnaire was used. This tool was developed based on the literature regarding the education of nurses and the clinical and educational validated tools. A researcher-designed tool was appropriate for this study, as the elements being measured and the constructs defined in the model required a close integration of the personal, the instructional, the academic, the clinical-environment, and the clinical-skills-development dimensions.

The questionnaire contained five major domains and, within those domains, 17 subscales. Each subscale contained 10 items, yielding a total of 170 items. The Personal Factors domain contained self-efficacy, motivation, coping, and emotional resilience. Instructional Factors contained the quality of feedback and supervision, and exposure to simulation. The Academic Factors contained the degree to which the curriculum and assessments were aligned and the presence of digital literacy. Within the Clinical Learning Environment, the Leadership and Workload of the Preceptor, as well as the Availability of Resources, were included, and finally, the Clinical Skills Development domain contained competence, confidence, and procedural accuracy as well as critical thinking. The responses were scored on a 5-point Likert scale, and the higher the score, the more favorable the perceptions.

Validity and Reliability

Content validity was established through a panel of five experts who reviewed items for clarity, relevance, and representativeness, as well as coverage and alignment with the constructs. During the pilot study, and as part of construct validity, items were subjected to an exploratory factor analysis (EFA) using Principal Axis Factoring with Varimax rotation. Items that did not meet a 0.50 factor loading, or that had significant cross-loadings, were considered for revision or removal. The resultant





factor structure from this analysis displayed a pattern that was consistent with the multidimensional structure of the ACCDM and its theoretical constructs.

A pilot test on a sample of 35 nursing students assessed internal consistency. No students were excluded. Scores on the 17 subscale measures were highly consistent. The lowest score of the subscales was for Self-Efficacy ($\alpha = .930$) and the highest score was for Preceptor Leadership ($\alpha = .985$). Alpha scores for Motivation, Coping, Emotional Resilience, Feedback, Supervision Quality, Simulation Exposure, Curriculum Alignment, Assessment, Digital Literacy, Workload, Resource Availability, Competence, Confidence, Procedural Accuracy, and Critical Thinking are reported as .956, .970, .957, .980, .980, .965, .978, .977, .977, .974, .959, .977, .963, .977, and .974, respectively.

The subscale scores of the pilot test also supported the hypothesis that there were strong item-total relationships. An example of scores in this area is Self-Efficacy (item-total scores .626 to .857) and Motivation (item-total scores .656 to .919). Item-total scores for the Clinical Skills Development subscales were strong. Based on strong item-total scores, the instrument was classified as reliable, and the pilot test was supportive of the planned administration of the questionnaire to additional study participants.

Table 1. Reliability of the Research Instrument

Domain	Subscale	Items	Cronbach's α
Personal Factors	Self-Efficacy	10	.930
	Motivation	10	.956
	Coping	10	.970
	Emotional Resilience	10	.957
Instructional Factors	Feedback	10	.980
	Supervision Quality	10	.980
	Simulation Exposure	10	.965
Academic Factors	Curriculum Alignment	10	.978
	Assessment	10	.977
	Digital Literacy	10	.977
Clinical Learning Environment	Preceptor Leadership	10	.985
	Workload	10	.974
	Resource Availability	10	.959
Clinical Skills Development	Competence	10	.977
	Confidence	10	.963
	Procedural Accuracy	10	.977
	Critical Thinking	10	.974

Data Collection Procedure

Collection of data was conducted after gaining the required approvals from the institutions and the ethics clearance from the Institutional Review Board (IRB). Prior to the recruitment of participants, the nursing deans and program managers were contacted.

Potential participants were informed of the aims, methods, possible advantages and disadvantages of the study, the protocols dealing with confidentiality, and their right to withdraw from the study at any time. They were required to give their written informed consent to participate.

To enable participation by students with different clinical schedules, the questionnaire was made available in paper and electronic form. Questionnaires were checked for completeness before being entered into IBM SPSS Statistics.

Data Analysis





IBM SPSS Statistics Version 29 and IBM SPSS AMOS Version 29 were used to conduct various analyses. Descriptive statistics and multiple regressions were conducted with SPSS, while CFA and SEM were conducted with AMOS. This study reported participant characteristics and study variables as frequencies, percentages, means, and SDs (standard deviations).

The relationships between the four predictor domains and the development of clinical skills were characterized and described with Pearson product-moment correlations. Regression analyses were then performed to describe the significant predictors and to determine the degree of variance in the clinical skills development that was accounted for by the predictor variables.

After the analyses of the observed variables, CFA was done in AMOS to assess the measurement model for the confirmation of the relationships between latent constructs and their observed indicators. SEM was then used to assess the relationships in the model between the latent constructs and clinical skills development. The model fit and theoretical consistency were the main criteria for selecting the final model.

CMIN/DF, NFI, TLI, CFI, GFI, and RMSEA were used to assess model fit. Model 5 had the best fit out of the 5 models tested (CMIN/DF = 1.448, $p = .072$, NFI = .991, TLI = .993, CFI = .996, GFI = .987, RMSEA = .032) and was retained for analysis.

Ethical Considerations

Approval to conduct the study and collect data was granted by the Institutional Review Board (IRB) at Liceo de Cagayan University. The study observed the ethical requirements of the Declaration of Helsinki and the Philippine Data Privacy Act of 2012 (Republic Act No. 10173). Participation was completely voluntary and required the provision of written informed consent. Participants were assured of anonymity and confidentiality and were free to withdraw from the study at any time and for any reason.

AI Disclosure

The use of Artificial Intelligence (ChatGPT) was strictly limited to the post-data analysis phase of the study and solely for the purpose of grammar and language editing of the study. AI was not incorporated in any other phase of the study (e.g., study design, data collection, and statistical analyses). The author of the study retained full control of the study and all the content therein, and all AI edits were made after verification by the authors. Such a practice is in line with the present-day guidelines of ethical publishing.

Results

Table 2. *Descriptive Statistics for Study Variables*

Variable	Mean	SD	Interpretation
Personal Factors	4.15	0.52	High
Instructional Factors	4.29	0.54	High
Academic Factors	4.27	0.56	High
Clinical Environment	4.21	0.55	High
Clinical Skills Development	4.19	0.57	High

Legend: 4.51–5.00 = **Strongly Agree** (Very High); 3.51–4.50 = **Agree** (High); 2.51–3.50 = **Neutral** (Moderately High); 1.51–2.50 = **Disagree** (Low); 1.00–1.50 = **Strongly Disagree** (Very Low).

Table 2 showed that participants expressed positive feedback on study variables, indicating a positive perception of students' learning experiences and the development of their clinical skills. The favorable responses demonstrate that the institutions involved in the study provide an educational context that aids the development of competence through quality teaching, sufficient preparation, and valuable clinical encounters. Though the personal factors construct received the lowest mean in comparison to the others, it remains in the high category, meaning that students possessed sufficient self-efficacy, motivation, and coping skills and emotional flexibility to take part in clinical learning. The higher mean values of the instructional, academic, and clinical environmental factors indicate that the support provided by the institutions is meant to reinforce personal readiness, while providing the





means to enhance self-efficacy, clinical skills, and professional judgment. In general, the study results provide support for the Apal Clinical Competency Development Model (ACCDM). Specifically, the results demonstrate that the interaction of the learner and the educational context is the basis for the development of clinical competence, and isolation of the educational context is not sufficient. The uniformly high ratings across the constructs indicate that competence, confidence, accuracy, and critical thinking of nursing students are a priority in the educational context.

Table 3. *Correlation Between the Study Variables and Clinical Skills Development*

Variable	r	p
Personal Factors	.668	<.001
Instructional Factors	.654	<.001
Academic Factors	.657	<.001
Clinical Environment	.747	<.001

Legend: r = Pearson product-moment correlation coefficient; p = probability value. Statistical significance was set at $p < .05$.

According to Table 3, all predictor variables were positively and significantly related to the development of clinical skills. This suggests that the enhancement of personal, instructional, academic, and clinical environment factors is related to developing competence, confidence, precision, and critical thinking skills. Of the predictor variables, the clinical learning environment was positively related to the greatest extent. This reinforces the importance of the presence of supportive preceptors, adequate learning resources, and valuable clinical placements that assist students in the learning process and enable them to translate theory into practice. Personal, instructional, and academic factors were positively correlated with clinical skills development, and the presence of multiple factors suggests that no single interpersonal factor is sufficient to explain the positive relationship to clinical competence. These results reflect the Apal Clinical Competency Development Model (ACCDM) and its multi-component model. The relationship of the multiple predictor variables provides support for the simultaneous application of Structural Equation Modeling (SEM) in order to capture the direct and indirect impacts on clinical skills development.

Table 4. *Multiple Regression Analysis*

Predictor	β	t	p
Assessment	.350	9.281	<.001
Self-Efficacy	.280	8.951	<.001
Digital Literacy	.134	3.540	<.001
Simulation Exposure	.111	3.323	.001
Supervision Quality	.099	2.632	.009
R²	F	p	
.634	204.68	<.001	
		1	

Legend: β = standardized regression coefficient (beta weight); t = t -statistic used to test the significance of each predictor; R^2 = coefficient of determination, representing the proportion of variance in clinical skills development explained by the regression model; F = overall F-statistic testing the significance of the regression model; p = probability value. Statistical significance was set at $p < .05$.

Table 4 showed five important observed-variable predictors of developing clinical skills. Among these, Assessment was the strongest predictor ($\beta = .350$, $p < .001$). Other predictors in decreasing order of significance are Self-Efficacy ($\beta = .280$, $p < .001$), Digital Literacy ($\beta = .134$, $p < .001$), Simulation Exposure ($\beta = .111$, $p = .001$), and Supervision Quality ($\beta = .099$, $p = .009$). The model was significant, with an analysis of variance result of ($F = 204.68$, $p < .001$) and a partial R statistic of .634. This result





allows for the rejection of H02. In contrast with the observed-variable regression, the SEM that follows is distinct because, for example, it deals with the evaluation of latent domains rather than the same set of individual indicators.

The second strongest predictor was self-efficacy. This suggested that students who possess self-efficacy carry out clinical skills, make clinical decisions, and are involved in the learning process to a greater degree. This strengthened the argument regarding the significance of individual preparation in the execution of clinical practice. Digital literacy was indicated as an important predictor. This describes the use and integration of digital technologies and health-related informatics in modern nursing education and incorporated evidence-based practice in clinical decision-making.

In addition to the above, the extent of exposure to simulation, as well as the quality of supervision, were important predictors of developing clinical skills. Simulation and supervision of practice in a clinical situation were highlighted as important predictors of developing clinical skills. Simulation allows students to develop psychomotor skills and clinical reasoning, while safe practice offers the opportunity for supervision that is both timely and constructive.

The regression model accounted for 63.4% of the variance in developing clinical skills. This relatively high value means the predictors, as a group, captured a great deal of the variation in the outcome, with the remaining 36.6% associated with factors outside of the regression model. This supports a multidimensional model of clinical skills development, but does not create causation.

Table 5. Summary of Goodness-of-Fit Indices of the Five Models

Model	CMIN/DF	P-Value	NFI	TLI	CFI	GFI	RMSEA
1	10.707	0.000	0.886	0.865	0.895	0.843	0.128
2	8.939	0.000	0.885	0.870	0.896	0.833	0.115
3	8.735	0.000	0.903	0.889	0.913	0.867	0.114
4	9.902	0.000	0.908	0.890	0.916	0.869	0.122
5	1.448	0.072	0.991	0.993	0.996	0.987	0.032

CMIN/DF- Chi-square divided by degrees of freedom

GFI - Goodness-of-Fit Index

NFI -Normed Fit Index

TLI- Tucker-Lewis Index

CFI -Comparative Fit Index

RMSEA -Root Mean Square Error of Approximation

Table 5 shows the fit indices for the five evaluated SEM models. Models 1 to 4 had poor fit compared to Model 5. As the best fit overall, Model 5 had CMIN/DF = 1.448, $p = .072$, NFI = .991, TLI = .993, CFI = .996, GFI = .987, and RMSEA = .032. These fit indices show that Model 5 fits best to the observed covariance structure among the models.

Model 5 was the final structural model because of its optimal model fit and the most observed theoretical coherence among the models. The finalized model describes the structural component of the ACCDM for the studied population.

When assessing the final model, it is important to consider the analyses that came before it. Clinical Environment was the strongest bivariate predictor in the Pearson analysis. Assessment was the strongest predictor of the observed variable in the multiple regression. Clinical Environment had the strongest latent direct path in the final SEM. They are different forms of analysis and should not be interpreted as conflicting results.



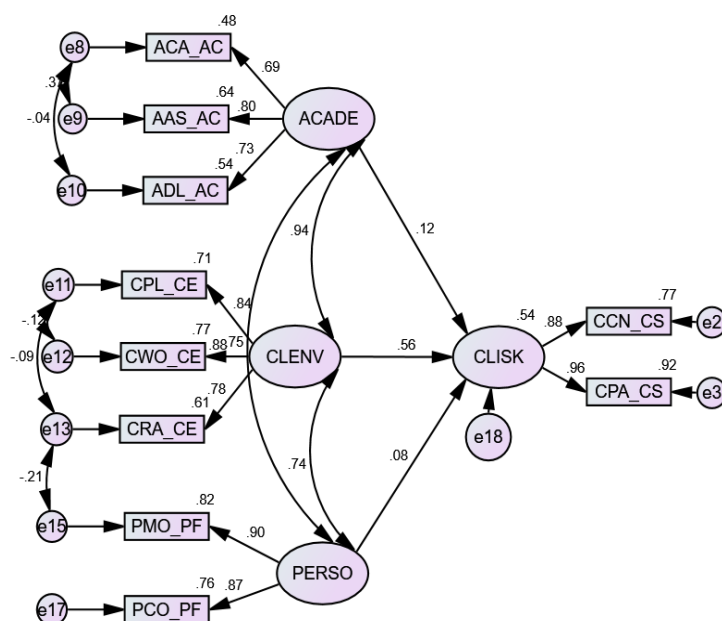


Figure 2 Model 5: Structural Equation Model (SEM) of Academic, Clinical Environment, and Personal Factors Influencing Clinical Skills Development

Legend:

- AAS_AC –Academic Factor: Assessment
- ACA_AC –Academic Factor: Curriculum Alignment
- ACADE – Academic Factors
- ADL_AC –Academic Factor: Digital Literacy
- CCN_CS – Clinical Skills: Competence
- CLENV – Clinical Environment
- CLISK – Clinical Skills
- CPA_CS –Clinical Skills: Procedural Accuracy
- CPL_CE –Clinical Environment: Preceptor Leadership
- CRA_CE – Clinical Environment: Resource Availability
- CWO_CE – Clinical Environment: Workload
- PCO_PF –Personal Factor: Coping
- PERSO – Personal Factors
- PMO_PF – Personal Factor: Motivation

Figure 2 represents the ACCDM model after SEM. It shows a good fit with the data, and the latent variables having a direct structural relation to the development of clinical skills were retained. For the finalized SEM, the clinical environment had the strongest standardized direct path to the development of clinical skills ($\beta = .562$), followed by academic ($\beta = .117$) and personal ($\beta = .080$) factors. This is different from the multiple regression outlined in Table 4, where Assessment had the strongest observed-variable predictor. This is due to the different levels of analysis in the two methods. In a multiple regression, the unique contributions of the observed variables are examined, while in SEM, the relations of latent constructs, which are represented by multiple observed variables, are evaluated.

The absence of the clinical environment as an important individual predictor in the multiple regression model doesn't imply that it does not contribute to the development of clinical skills. The



clinical-environment indicators may have considerable overlap with the other predictors included in the regression model. When predictors are correlated, the multiple regression model captures the unique contribution of each variable after accounting for the overlap with the other predictors. Because of this, a variable may show a strong relationship with an outcome in the bivariate context, but may not be a significant predictor in the context of multiple regression. This is in line with the present findings, as the clinical environment had the strongest bivariate relationship with the development of clinical skills, but Assessment had the strongest individual predictive power in the regression model. However, in the context of latent constructs, the SEM model combined the clinical environment indicators, and the SEM model identified the clinical environment as the strongest direct latent construct ($\beta = .562$).

The academic factors had a positive direct effect on the development of clinical skills ($\beta = .117$). The indicators of academic skills were assessment, curriculum alignment, and digital literacy, and they all suggested that the academic skills threshold influences students' readiness to engage with clinical practice. The positive direct effect of the personal factors on the development of clinical skills was also noted ($\beta = .080$). In the last SEM model, this construct was represented by coping and motivation. The SEM model indicates personal readiness has a direct effect, and the size of the effect has to be interpreted as a relative direct effect in the context of the other variables.

The final SEM indicated associations among the academic, clinical-environment, and personal domains, which are exogenous constructs. We cannot interpret the structural paths associated with these domains because the available structural-weight table does not offer p-values. However, we report those paths' standardized coefficients. We refrain from making any claims on the statistical significance of the paths.

The measurement model was confirmed, supported by the standardized factor loadings. The observed indicators retained in the model had high factor loadings on their respective latent constructs. Competence ($\beta = .875$) and Procedural Accuracy ($\beta = .957$) had high factor loadings on the clinical skills development construct. Thus, these indicators had substantive meaning in relation to that construct.

The SEM results validate the ACCDM in the population studied. The results also indicate that the clinical environment is the strongest latent direct influence and that Assessment is the strongest individual observed-variable predictor identified in a multiple regression analysis. These results are complementary. The SEM results of this study also validate the ACCDM as an evidence-informed framework for the design of curricula, competency-based assessments, and for the planning of instruction and clinical learning environments.

Table 6. Regression Weights of the Default Model (Group5)

			B	S.E.	C.R.	BETA	P
CLISK	<---	ACADE	.279			.117	
CLISK	<---	CLENV	1.267			.562	
CLISK	<---	PERSO	.093			.080	
AAS_AC	<---	ACADE	1.000			.801	
ACA_AC	<---	ACADE	.916	.042	21.602	.694	***
CWO_CE	<---	CLENV	1.000			.878	
CPL_CE	<---	CLENV	1.019	.042	24.344	.845	***
PMO_PF	<---	PERSO	.548			.904	
CRA_CE	<---	CLENV	.874	.039	22.147	.780	***
ADL_AC	<---	ACADE	.973	.052	18.662	.732	***
PCO_PF	<---	PERSO	.549			.869	
CCN_CS	<---	CLISK	.506			.875	
CPA_CS	<---	CLISK	.518			.957	





Table 6. Default Model (Group 5) showed the finalized structural equation model standardized regression weights and SEM standardized factor loadings of measurement indicators. The outcomes of the analysis should be interpreted at two distinct levels: (1) structural paths among latent constructs, and (2) measurement loadings of the observed indicators.

From a structural perspective, the clinical environment exhibited the strongest standardized direct path to the development of clinical skills ($\beta = .562$). This was followed by the direct paths of the academic ($\beta = .117$) and personal ($\beta = .080$) factors. These regression weights capture the direct relations of the latent predictor constructs and the latent construct of clinical skills development. Thus, within the finalized SEM, the clinical environment was the most influential latent domain regarding the development of clinical skills.

This finding does not contradict the results of the multiple regression analysis (Table 4), where Assessment was the most influential predictor. The two models operate at different levels. The multiple regression examines the degree of influence of a specific observed variable after controlling for the effects of other observed variables. In contrast, SEM assesses the directionality of the relationships among latent constructs that are represented by several measurement indicators. Therefore, the clinical environment may exert a substantial influence at the latent domain level, notwithstanding that its measurement indicators do not significantly predict in the multiple regression analysis. The stronger SEM coefficient amplifies the total influence of the construct of clinical environment rather than the influence of a specific indicator of clinical environment.

At the measurement level, the components of the academic construct included Assessment ($\beta = .801$), Curriculum Alignment ($\beta = .694$), and Digital Literacy ($\beta = .732$). Strong standard loadings suggest that all observed indicators contributed significantly to the academic latent construct measured. Assessment had the highest loading of the three.

Workload ($\beta = .878$), Preceptor Leadership ($\beta = .845$), and Resource Availability ($\beta = .780$) are included in the clinical-environment construct. Workload had the highest loading, but all three indicators contributed significantly to the clinical-environment construct.

For the personal construct, Motivation ($\beta = .904$) and Coping ($\beta = .869$) were both highly and significantly related to the personal latent construct of the model.

For Clinical Skills Development, Competence ($\beta = .875$) and Procedural Accuracy ($\beta = .957$) had strong standard loadings, with Procedural Accuracy having the highest loading as the most representative of clinical skills development in the framework.

The standard loadings across all constructs and the structural coefficients demonstrated the direct relationships of the latent constructs with clinical skills development. From this perspective, the finalized SEM was better able to capture the ACCDM as compared to the observed-variable regression. There is a significant caveat to the interpretation of Table 6 output. The output does not provide the p-values associated with the three structural paths leading from the Academic, Clinical Environment, and Personal Factors to the Clinical Skills Development. Thus, we can only comment on the structural paths based on the provided standardized coefficients. Unless the corresponding C.R. and p-values are verified in the original AMOS output, the pathways from the Academic and Clinical Environment Factors to Clinical Skills Development cannot be claimed to be statistically significant. For the remaining measurement paths, C.R. and significance values are provided, thus enabling direct statistical verification of their respective indicators.

Table 7. Explained Variance of the Structural Model

Endogenous Variable	R ²	Interpretation
Clinical Skills Development	.634	Substantial

Table 7 shows that the last structural model accounts for the variance in Clinical Skills Development at 63.4% ($R^2 = .634$). Thus, the model has considerable explanatory power. This result indicates that the latent constructs in the ACCDM explain a considerable part of the variance regarding the clinical skills development of nursing students. The remaining 36.6% of the variance in clinical





skills development suggests that there are constructs that are not in the model that may also explain clinical skills development. These may be personal, organizational, clinical, or situational constructs that were not in the scope of the current study. Therefore, while the R^2 value provides a picture of the model regarding the variance that is relevant to the study population, it may not be used for interpreting explanatory power for relationships.

Discussion

The evolution of clinical skills development has manifested as a multifaceted occurrence influenced by the interplay of personal, academic, pedagogical, and clinical-environmental elements. Analyzing the results necessitates consideration of the specific objectives of the statistical methods utilized. Descriptive statistics delineated the levels of the study variables, Pearson correlation analysis revealed bivariate associations, multiple regression assessed the distinct contribution of individual observed variables, and structural equation modeling (SEM) investigated relationships among latent constructs and appraised the overall Apal Clinical Competency Development Model (ACCDM). Due to the differing analytical levels of regression and SEM, their outcomes ought to be seen as complementing rather than as conflicting interpretations of clinical skills advancement (Hair et al., 2019; Kline, 2023).

Relationships Between the Predictor Domains and Clinical Skills Development

The correlation analysis indicated that all four predictor domains were positively and significantly linked to the advancement of clinical abilities. The clinical setting had the most robust bivariate correlation, $r = .747$, $p < .001$. Consequently, the initial null hypothesis (H_01) was dismissed. This finding suggests that students who viewed their clinical settings more favorably were likely to indicate greater advancements in their clinical skills.

The robustness of this correlation aligns with findings indicating that clinical learning settings significantly influence the competence development of nursing students. Nurturing environments enable possibilities for guided practice, professional engagement, constructive criticism, and the use of academic knowledge in patient care (Chan et al., 2023; Flott & Linden, 2022). The experiences of students can be enhanced when clinical placements provide a sense of belonging, engagement, and psychological safety (Levett-Jones et al., 2022). On the other hand, settings marked by restricted educational prospects, insufficient resources, or unhelpful social interactions may hinder students' self-assurance and involvement.

Nonetheless, the bivariate association must not be construed as proof that the clinical setting was definitively the most potent independent predictor. Correlation quantifies the link between two variables while disregarding their interactions with additional factors. The identified correlation may consequently indicate shared variance with the quality of supervision, exposure to simulations, evaluation methods, educational background, and learner attributes. Moreover, the correlational and cross-sectional characteristics of the data fail to demonstrate a causal link between the clinical setting and the enhancement of abilities.

Observed-Variable Predictors of Clinical Skills Development

Multiple regression analysis offered a more detailed understanding of the elements linked to the development of clinical abilities by quantifying the distinct impact of each identified predictor while accounting for the other variables. Evaluation surfaced as the most significant predictor ($\beta = .350$), succeeded by self-efficacy ($\beta = .280$), digital literacy ($\beta = .134$), exposure to simulations ($\beta = .111$), and the quality of supervision ($\beta = .099$). The regression model demonstrated statistical significance, $F = 204.68$, $p < .001$, and accounted for 63.4% of the variance in the development of clinical abilities. These results corroborated the dismissal of the second null hypothesis (H_02).

The significance of assessment highlights the necessity of synchronizing evaluation methods with desired nursing competencies. Competency-based evaluation conveys anticipated performance, guides students' learning endeavors, and offers proof of their capacity to amalgamate information, discernment, and clinical expertise. This analysis aligns with constructive alignment, which underscores the harmony between planned learning outcomes, teaching activities, and assessment criteria (Biggs & Tang, 2022). Evaluation must consequently encompass more than mere recollection of theoretical concepts and





assess students' proficiency in applying knowledge, executing procedures, making clinical decisions, and responding appropriately to authentic patient-care scenarios.

Self-efficacy emerged as the second most significant predictor, reinforcing the notion that students' perceptions of their skills affect their readiness to undertake tough tasks, endure through obstacles, and rebound from failures (Bandura, 2006). In nursing education, self-efficacy has been linked to learning involvement, clinical effectiveness, and the advancement of competence (Arribas-Marín et al., 2024; Shorey et al., 2023). Learners possessing heightened self-efficacy are likely to engage more proactively in clinical endeavors and capitalize on accessible educational resources. Nevertheless, self-efficacy ought not to be regarded merely as an intrinsic human trait. It can be enhanced via effective execution, constructive criticism, suitable exemplification, and increasingly demanding educational encounters.

Digital literacy has also provided a notable and distinct contribution. Modern nursing students are required to navigate digital educational platforms, electronic clinical tools, and technology-enhanced learning settings. Blended and technology-enhanced education can promote access to information, clinical reasoning, engagement, and autonomous learning when effectively included in the curriculum (Chang et al., 2022; Nguyen et al., 2023). However, mere access to technology may not cultivate proficiency; students need to assess information, utilize digital instruments effectively, and apply digitally-enhanced learning in clinical settings.

Simulation exposure emerged as another crucial predictor. Simulation offers a regulated setting where students can rehearse operations, analyze clinical data, and make judgments without endangering real patients. Research indicates that simulation-based education can enhance clinical competencies, self-assurance, and readiness, especially when it incorporates thoughtfully crafted scenarios and organized reflection or debriefing (Cant & Cooper, 2017; Koukourikos et al., 2021; Uppor et al., 2023). The above results indicate that simulation ought to be methodically incorporated into the curriculum and directly linked to competency evaluation and clinical placement opportunities.

Ultimately, the quality of supervision had a crucial role in the enhancement of clinical abilities, despite its standardized coefficient being less than that of other notable predictors. Proficient supervisors facilitate educational opportunities, exemplify professional conduct, deliver prompt feedback, and assist students as they undertake progressively intricate duties. Clinical educators serve as exemplary professionals whose mentorship can enhance students' self-assurance and professional identity (Henderson et al., 2021; Rodríguez-García et al., 2022). The comparatively lower regression coefficient does not suggest that supervision lacks educational significance; its impact may intersect with more extensive characteristics of the clinical learning context.

Reconciling the Correlation and Regression Findings

Despite the clinical setting exhibiting the most robust bivariate connection with the advancement of clinical abilities, it did not appear as a significant independent predictor in the multiple regression analysis. This outcome is not inconsistent. It suggests that a significant portion of the correlation between the measured clinical environment and the development of clinical abilities may have been accounted for by other factors in the model.

Clinical settings consist of interconnected educational factors, such as oversight, constructive criticism, opportunities for learning, available resources, social interactions, and institutional backing (Chan et al., 2023; Flott & Linden, 2022). When these interconnected traits are concurrently incorporated into a regression model, their shared variance is allocated among the predictors. The insignificant regression coefficient indicates that the clinical-environment variable did not account for any further variance once the other predictors were statistically adjusted. It does not indicate that the clinical setting is inconsequential or devoid of connection to the advancement of clinical abilities.

This differentiation is crucial for educational analysis. A conducive clinical setting might indirectly enhance competence by fostering better supervision, augmenting students' engagement with significant practice, bolstering self-efficacy, and facilitating the application of academic and simulation training in patient-care contexts. Consequently, the therapeutic setting may serve as a facilitating context wherein more particular instructional and individual characteristics interact, rather than acting as a standalone predictor.





Latent Relationships in the ACCDM

SEM offered an additional viewpoint by analyzing the predictor domains as latent constructs indicated by various observable metrics. In Model 5, the clinical setting exhibited the most robust standardized direct influence on the development of clinical abilities ($\beta = .562$), succeeded by academic elements ($\beta = .117$) and personal attributes ($\beta = .080$). The model exhibited a satisfactory to exceptional fit: $\chi^2/df = 1.448$, $p = .072$, NFI = .991, TLI = .993, CFI = .996, GFI = .987, and RMSEA = .032. These indices fulfilled the model-testing criteria of the study and substantiated the rejection of the third null hypothesis (H₀₃). The elevated incremental fit indices and diminished RMSEA suggest that the proposed model well depicted the observed covariance structure (Hair et al., 2019; Kline, 2023).

The robust underlying connection between the clinical environment and the advancement of clinical abilities aligns with studies that recognize clinical placements as pivotal for competence enhancement (Kaihlainen et al., 2023; Sulosaari et al., 2022). Clinical proficiency is cultivated by engagement in patient care, supervised practice, monitoring of professional duties, constructive feedback, introspection, and gradually escalating responsibilities. Experiential-learning viewpoints also highlight that information is altered via experience, contemplation, conceptualization, and later implementation (Kolb, 1984; Yardley et al., 2012).

The robust clinical-environment trajectory in SEM does not contradict the insignificant observed-variable coefficient found in the regression analysis. Regression assessed the distinct impact of a particular measured variable while accounting for other observed factors. Conversely, SEM depicted the clinical setting as a latent variable derived from the shared variance of its selected indicators. The latent construct could encapsulate the more extensive and consistent foundational attribute of students' clinical experiences, simultaneously minimizing measurement error related to specific indicators (Hair et al., 2019; Kline, 2023). Consequently, the two analyzes address distinct inquiries: regression determines which particular observed variables provide unique statistical input, whereas SEM assesses the structural relationships among broader theoretical domains.

The notable influences of academic and personal elements further illustrate that proficiency cannot be solely attributed to clinical experience. Scholarly training provides the conceptual basis for evaluation, reasoning, and clinical judgment, whereas individual characteristics like self-efficacy affect students' interaction with educational experiences. The less robust standardized pathways should not be construed as proof that these areas lack significance. Their impacts may function in conjunction with, or partially via, the clinical setting and educational methodologies.

Integrated Interpretation of the ACCDM

The findings collectively endorse the multifaceted framework of the ACCDM. At the level of observable variables, competency-based evaluation and self-efficacy emerged as the primary predictors, succeeded by digital literacy, exposure to simulations, and the quality of supervision. At the latent-construct level, the clinical setting exhibited the most robust direct correlation with the advancement of clinical abilities. These results illustrate the necessity of evaluating clinical ability at both detailed and overarching theoretical dimensions.

The results endorse a holistic methodology in nursing education where assessment, academic training, self-efficacy, simulation, digital competency, oversight, and the clinical setting are regarded as interconnected elements. Competency-based evaluation can elucidate anticipated performance; simulation can offer secure avenues for practice; digital proficiency can enhance access to educational materials; and exemplary oversight can link knowledge with real patient care. Nonetheless, these pedagogical approaches are expected to yield optimal results when executed in a therapeutic setting that offers sufficient resources, supportive relationships, constructive feedback, a sense of belonging, and significant possibilities for engagement.

The ACCDM posits that enhancing clinical skills development necessitates unified institutional efforts instead of fragmented educational initiatives. Private tertiary education establishments ought to synchronize competency outcomes, pedagogical activities, evaluative processes, simulation experiences, faculty enhancement, and clinical collaborations. The findings ought to be regarded as indications of statistical correlations rather than definitive proof of causative links. Future longitudinal or experimental studies are required to ascertain how alterations in these areas affect students' clinical proficiency over time.



Limitations

There are a few constraints to this study. The first is that its design is cross-sectional and correlational. Therefore, there is a limitation in interpreting the relationships identified, in that the associations presented should be regarded as such, without assuming the predictors impact the development of clinical skills. The second limitation is that the research utilized self-reported data and thus is subject to assessment and social desirability bias, which may impact the results. The third limitation is that the nursing students who participated in this study were only Level III and IV students of the three private higher educational institutions in Iligan City, which impacts the applicability of the outcomes to other institutions, locations, and even other educational contexts. Although the instruments used in this study were developed by the researcher, were reviewed by experts, and underwent exploratory factor analysis and a pilot study for reliability, their psychometric properties should be assessed in future studies.

Finally, multiple regression and SEM analyses are different levels of analysis and should not be assessed as the same. The results of regression state that the selected indicators contributed, while in SEM the relationships are defined amongst the constructs which are not directly measured. The ACCDM should be reproduced in various nursing education environments and should utilize a longitudinal approach, mixed-methods, or designs with interventions to assess the model in relation to its stability and to explore its usefulness.



Figure 3. *Apal Clinical Competency Development Model (ACCDM)*

The Apal Clinical Competency Development Model is an evidence-dense, multi-dimensional development model that maps the context of personal, academic, instructional, and clinical contextual factors that shape the development of clinical skills for undergraduate nursing students. The main innovation of the model is this mapping in an integrated structural framework. Moreover, in the Philippine context of private higher education, it provides an empirical basis for mapping relationships among the aforementioned factors using structural equation modeling (SEM).

The results, at both the observed-variable and latent-construct levels, provide supporting evidence. During the multiple regression analysis, assessment was the most significant observed-variable predictor of clinical skills development ($\beta = .350$). In the final SEM, the clinical learning environment was the most significant latent direct predictor ($\beta = .562$). This differentiation strengthens the interpretation of the ACCDM because it shows that, depending on the context in which the factors are examined, the importance of the factor may vary. The model, therefore, captures the importance of all the factors, reinforcing the multiple dimensions of clinical skills development.

The ACCDM captures an integrated view of the readiness of the learner, the academic and clinical instructional contexts, and the confidence, competency, accuracy, and thinking of the learner. From a practical perspective, the model provides a framework, for the first time, to guide the redesign



of curricula, competency-based evaluations, faculty development, simulations, and clinical collaborations.

For nursing education institutions, the ACCDM framework may assist in determining whether educational and clinical learning opportunities are in balance with the needed clinical competencies. The ACCDM framework may also aid in the analysis of various assessment techniques, instructional methods, simulation, and the clinical learning environment. By providing areas to be examined and assessed, the framework may assist in the evaluation of a program and facilitate quality improvement. The ACCDM may also assist in evaluating teaching and learning methods and their impact on the clinical skills of students. The framework, however, should not be used as a measure of program effectiveness due to the design of the study, which was cross-sectional, and the limited scope of the nursing student population examined.

The ACCDM explained a large portion of the variance in the development of clinical skills of study participants with a substantial research fit at 63.4% ($R^2 = .634$). In the context of the study, the results provided research justification for the ACCDM. It should be noted that the use of the ACCDM outside of the study participants' organizations, regions, and educational contexts will require additional research.

Recommendations

For Nursing Education Institutions. Nursing schools should utilize the Apal Clinical Competency Development Model (ACCDM) to guide the review and improvement of their curriculum by integrating competency-based assessments and incorporating simulation and digital health competencies, along with structured clinical learning. Faculty development should center around the clinical supervision and teaching of the faculty with clinical support and structure.

For Clinical Instructors. Clinical instructors should offer structured mentorship, along with timely feedback and engagement in reflective learning and simulation exercises to develop students' self-efficacy as well as their clinical and procedural competencies.

For Network Hospitals and Clinical Partners. Healthcare establishments should enhance the collaboration with nursing schools through the development of preceptor programs, the harmonization of clinical mentorship, and the creation of supportive clinical learning environments with the necessary learning materials and appropriate clinical engagement.

For Future Research. Future research should focus on the validation of the ACCDM in nursing education with a variety of research designs and methods, including mixed-methods, longitudinal, and experimental studies, in order to assess the long-standing impact of the ACCDM and improve the ACCDM for more extensive use in competency-based nursing education.

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