

Association between Problem-Solving Skills and Knowledge of the Nursing Process and Standardized Nursing Languages among Undergraduate Nursing Students

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Abstract

Introduction. Problem-solving skills and the use of Standardized Nursing Languages (SNLs) are essential for clinical reasoning in nursing education, yet their relationship has been insufficiently explored. This study aimed to describe nursing students' characteristics alongside their problem-solving skills, compare these across program years, and identify predictors of their knowledge of the nursing process and SNLs, with a specific focus on problem solving.

Methods. A prospective observational study was conducted in 2024–2025 among undergraduate nursing students in a public university in Italy. Data were collected through an online survey including a knowledge test on SNLs, the Positions on Nursing Diagnosis scale, and the Problem-Solving Inventory (PSI). Descriptive statistics, ANOVA, correlation analyses, and multiple linear regression were performed.

Results. A total of 352 students participated (87.5% female; mean age 22.79). Knowledge levels did not significantly differ across academic years. Higher knowledge was associated with better academic performance, stronger intention to use nursing diagnoses, and higher PSI-Self-Assurance, while

larger class size and male sex were negatively associated with knowledge. Regression analysis identified PSI-Self-Assurance, intention to use nursing diagnoses, class size, and sex as significant predictors ($R^2 = 0.11$).

Discussion. Knowledge of the nursing process and SNLs appears to be more strongly influenced by motivational and cognitive factors than by academic progression alone. Confidence in problem-solving and intentional engagement with nursing diagnoses emerge as key elements in supporting diagnostic reasoning.

Keywords: Problem Solving, Standardized Nursing Languages, Nursing Process, Nursing Students

Introduction

Problem solving refers to a systematic, goal-oriented process that integrates thinking, emotional regulation, and behavioral responses to adapt to situational demands or overcome obstacles (Li & Luo, 2022).

In the literature, problem solving has typically been conceptualized as a dimension within the broader critical thinking framework that can be influenced by specific educational interventions (Kong et al., 2014; Wei et al., 2024). Indeed, increasing attention has been directed toward educational strategies aimed at strengthening students' problem-solving abilities in nursing education (Günüşen et al., 2014; Huang et al., 2023; Kanbay & Okanlı, 2017). Instructional approaches, such as team-based learning, validated case studies, escape rooms, and immersive virtual reality, have shown promising results in improving students' engagement and problem-solving performance (Hsieh et al., 2025; Köse & Özcan, 2025; Leandro et al., 2024; Yeung et al., 2023). Therefore, problem solving has commonly been examined as an outcome of educational interventions influenced by a range of individual and contextual factors (Choi & Jeon, 2022; Jo & Hwang, 2022; Yildirim et al., 2019). It may also be conceptualized as an intrinsic and relatively stable ability of individuals and, therefore a potential predictor of other educational outcomes, such as knowledge acquisition and learning performance (Hacatrjana, 2022; Heppner & Petersen, 1982). Although this perspective has been less common in the literature, it provides a useful framework for examining the role of problem-solving abilities in determining learning outcomes and is adopted in the present study.

Links Between Problem Solving and Standardized Nursing Languages in Nursing Education

Problem solving has long been recognized as a core component of the nursing process, enabling professionals to integrate theoretical knowledge with clinical practice and supporting safe and effective patient care (Ahmady & Shahbazi, 2020; Hants et al., 2023; Rodríguez-Suárez et al., 2023; Wang et al., 2004). For this reason, in the educational context, increasing attention has been paid to the role of the nursing process and Standardized Nursing Languages (SNLs) as cognitive and educational frameworks supporting problem solving. SNLs, such as standardized nursing diagnoses, interventions, and outcomes, are widely used to structure clinical reasoning, promote consistency in care planning, and make nursing decision making explicit and communicable (Johnson et al., 2018; Jones et al., 2010). The integration between problem solving, nursing process, and SNLs can be broadly categorized into four main trends in the literature:

1. Structured clinical reasoning frameworks grounded in the nursing process and supported by SNLs: These approaches conceptualize problem solving as the application of critical reasoning across the phases of assessment, diagnosis, planning, implementation, and evaluation. Their primary aim is to make students' reasoning explicit and to foster coherent links between assessment, decision making, and nursing actions (Kautz et al., 2006; Kuiper et al., 2009; Seo & Eom, 2021; Tesoro et al., 2021).
2. The nursing process conceptualized as a problem-solving framework: From this

perspective, students' reasoning is guided by predefined phases and is often supported by SNLs rather than by independent measures of problem-solving ability (Bayindir Çevik & Olgun, 2015; Bertocchi et al., 2024; Wang et al., 2004).

3. Studies focusing on students' perceptions and learning experiences: These suggest that SNLs may enhance perceived problem-solving abilities by supporting accurate problem analysis, nursing diagnosis formulation, and coherent care planning. However, the findings are mainly based on self-reported data rather than objective measures (Karaca & Aslan, 2018; Smith & Craft-Rosenberg, 2010; Yalcinkaya et al., 2025).
4. Clinical application studies: In these contexts, SNLs help externalize of problem-solving processes within the nursing process, making them observable and partially assessable in real-world settings (Hants et al., 2023; Zeffiro et al., 2025).

While problem solving is widely acknowledged as a core competency in nursing education and has been extensively investigated, existing research has mainly focused on educational interventions, instructional models, and students' perceptions. To date, however, no empirical studies have examined the association between undergraduate nursing students' problem-solving skills and their knowledge of the nursing process and SNLs. Clarifying this relationship is essential for designing educational and assessment strategies that strengthen clinical reasoning and promote the effective integration of theory and practice in nursing education.

Therefore, the present study aimed to examine the association between problem-solving skills and knowledge of the nursing process and SNLs among undergraduate nursing students. In particular, it sought (a) to describe the sociodemographic, academic and educational characteristics of the students and their levels of problem-solving skills, attitudes toward nursing diagnoses, and knowledge of the nursing process and SNLs; (b) to examine differences in these variables across the years of the nursing program; (c) to identify factors independently associated with students' knowledge of the nursing process and SNLs.

Methods

Design

An observational study was conducted. The Strengthening the Reporting of Observational Studies in Epidemiology guidelines (von Elm et al., 2007) were used as a reference for the development and implementation of the study.

Sample and setting

The study included a convenience sample of all nursing students enrolled in academic year 2024-2025 in the three-year nursing bachelor's programs at a public university. This university has campuses in two Italian regions (one central and one southern).

Data collection process

Prior to data collection, the survey was piloted with five nursing students to assess its clarity and estimate the time needed to complete it. The data were then collected from February 2025 to May 2025 through a pre-arranged online form sent to the students by the course directors via email. The email included a short description of the study and the survey link. A reminder was sent midway through the data collection period.

Instruments and variables considered

The survey consisted of several sections aimed at assessing the main study variables, followed by contextual educational information and the participants' sociodemographic characteristics.

Problem-solving skills were assessed using the Problem-Solving Inventory (PSI), which evaluates individuals' perceptions of their own problem-solving abilities. The instrument consists of 35 items distributed across three dimensions: Self-Assurance, which reflects confidence in one's ability to successfully handle and solve problems; Engagement, which reflects the tendency to actively approach and engage in solving problems rather than avoid them; and Methodical Thinking, which reflects the ability to remain systematic, deliberate, and thoughtful during problem solving instead of acting impulsively. Items were rated on a six-point Likert scale ranging from 1 (strongly agree) to 6 (strongly disagree). Subscale scores were calculated by summing the relevant items, while the total PSI score was obtained by summing all items. Lower scores indicate greater perceived problem-solving effectiveness.

The Italian version of the PSI showed good psychometric properties (Nota et al., 2013).

Attitudes toward nursing diagnosis were assessed using the Positions on Nursing Diagnosis (PND) Scale, which measures perception through a semantic differential format based on pairs of contrasting adjectives (e.g., ambiguous/clear, relevant/irrelevant). Each pair is rated on a seven-point scale ranging from 1 (most negative attitude) to 7 (best attitude). The total score ranges from 20 to 140, with higher scores indicating more positive attitudes toward nursing diagnoses. This instrument also includes a preliminary question, rated on a scale from 0 (not at all favorable) to 10 (extremely favorable) about the intention to use nursing diagnoses in clinical practice. The Italian version of the PND scale showed very good psychometric properties (D'Agostino et al., 2016).

Students' knowledge of the nursing process and SNLs was assessed using a 19-item questionnaire specifically developed for this study. The questionnaire included both general knowledge questions (e.g., phases of the nursing process or the structure of a NANDA-I nursing diagnosis) and short clinical scenarios requiring the identification of appropriate assessment indicators or care planning decisions. The questionnaire was specifically developed for this study by a panel of four nursing academics, all of whom were experienced lecturers in undergraduate nursing education and regularly involved in teaching the nursing process and SNLs. The items were generated to cover the key domains of knowledge related to the nursing process, nursing diagnoses, and care planning. Clinical scenarios were also developed by the same expert panel to reflect common educational situations encountered by undergraduate nursing students. All items were independently reviewed and discussed during a couple of focus groups by the four experts until unanimous agreement was reached regarding their relevance, clarity, and comprehensiveness with the intended learning objectives. Moreover, the questionnaire underwent pilot testing with ten nursing students before its final administration.

The final version included 19 multiple-choice items, each scored as correct (1 point) or incorrect (0 points), resulting in a total score ranging from 0 to 19, with higher scores indicating greater knowledge. The internal consistency of the questionnaire was assessed using Kuder-Richardson Formula 20 (KR-20) for dichotomous items, showing good reliability (KR-20 = 0.814).

Self-perceived competence in applying the nursing process and SNLs was assessed through 13 items rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The items explore the students' perceived ability to formulate nursing diagnoses, document care processes using SNLs, recognize patient needs during assessment, and identify changes in patients' care needs. The total score was calculated by averaging the scores across all items.

An additional section explored the training received regarding the nursing process and SNLs during the nursing program, as well as the teaching methods used, such as lectures, practical exercises, and simulation-based learning activities.

Finally, information on sociodemographic and academic characteristics was collected, including age, sex, marital status, country of origin, type of high school attended, previous university degrees, average examination grades, number of completed internship hours, and average weekly study hours.

Data analysis

All statistical analyses were performed using IBM SPSS Statistics (version 22.0). Descriptive statistics (means, standard deviations, frequencies, and percentages) were calculated to summarize the participants' sociodemographic and academic characteristics, as well as the main study variables.

Differences across the three academic years were examined through one-way ANOVA. When significant effects were detected, Bonferroni post-hoc tests were applied to adjust for multiple comparisons. Pearson's correlation coefficients were calculated to explore associations between sociodemographic, academic, and personal variables and the level of knowledge of the nursing process and SNLs. Variables significantly associated with the level of knowledge were entered into a multiple linear regression model. Given the exploratory nature of the study and the limited empirical evidence regarding factors associated with nursing students' knowledge of the nursing process and SNLs, a backward elimination procedure was adopted to identify the variables independently associated with the outcome and to derive a more parsimonious model.

Candidate predictors included age, sex, class size, mean exam evaluation, hours of internship

completed, study hours per week, intention to use nursing diagnoses, and PSI subscales. Statistical assumptions were verified. A two-tailed significance level of $p < 0.05$ was adopted for all statistical tests.

Ethical consideration

The research protocol was approved by the internal review board of the university. Participation was voluntary and anonymous, and no directly identifying information (e.g., names, ID numbers, or contact details) was collected. The data included only general personal and academic information. All participants were informed about the purpose of the study and provided their consent by completing the questionnaire.

Results

Sociodemographic, academic and educational characteristics

A sample of 352 students, mostly Italians (92.61%), was included in the study. The mean age of the participants was 22.79 years ($SD = 5.47$), with a greater female representation (87.5%). Most of the students were from areas near the university (71.31%) and did not work (77.56%). The students' distribution across academic years was as follows: first year ($n = 127$), second year ($n = 100$), and third year ($n = 125$). The students completed approximately a mean of 988 hours of internship out of 2,400 hours for the three years and reported studying for an average of 3 hours per week (Table 1). During these academic periods, the students were primarily involved in clinical training activities, with internships constituting the main component of their weekly schedules.

In 71.6% of cases, the lecturer covered both the nursing process and SNLs, while in 26.4% of cases, the lecturer addressed the nursing process without going into detail about SNLs. Half of the participants (50.9%) reported that their primary learning method for the nursing process and SNLs was lectures, while 27.3% integrated lectures with clinical cases. Only 9% of the participants supported the inclusion of technology in the curriculum. Regarding self-perceived knowledge in applying the nursing process and SNLs, in most cases, most students reported only partial confidence in having acquired the necessary knowledge.

Table 1. Students' characteristics (N = 352).

Variable	Number	%	mean	SD
Sociodemographic				
Age			22.79	5.47
Sex (Female)	308	87.50		
Marital status				
Single	332	94.32		
Married/cohabiting	18	5.11		
Divorced	2	0.57		
Country of origin				
Italy	326	92.61		
Romania	7	1.99		
Brazil	4	1.14		
Cameroon	2	0.57		
Macedonia	2	0.57		
Nigeria	2	0.57		
Peru	2	0.57		
Congo	1	0.28		
Croatia	1	0.28		
Philippines	1	0.28		
Moldova	1	0.28		
Poland	1	0.28		
Germany	1	0.28		
Ukraine	1	0.28		
Student worker (No)	273	77.56		
Off-site student (No)	251	71.31		
High-school diploma				
Scientific	111	31.53		
Human sciences	63	17.90		
Linguistic	46	13.07		
Classic	45	12.78		
Technical institute	40	11.36		
Professional institute	35	9.94		
Arts	7	1.99		
Applied sciences	2	0.57		
Music	2	0.57		
Social health	1	0.28		
Academic				
Course year				
1° year	127	36.08		
2° year	100	28.41		
3° year	125	35.51		
Class size			80.15	40.02
Mean exams evaluation			24.72	1.96
Hours of internship completed			988.29	691.73
Study hours per week			3.03	1.16
PSI* - Engagement			42.53	14.61
PSI* - Self-Assurance			22.80	8.79
PSI* - Methodical Thinking			11.26	5.08
PND** Scale total score			83.02	10.57
Intention to use nursing diagnoses			8.13	2.08
Self-perceived competence in applying nursing process and SNLs			3.21	0.69

* Problem Solving Inventory;

** Position on Nursing Diagnosis.

Differences across years of nursing courses

A significant difference was observed in the PSI-Engagement dimension ($p = 0.006$), which showed a progressive decrease from the first to the third year. The Bonferroni post-hoc test indicated that first-year students scored

significantly higher than third-year students ($p = 0.005$). Similarly, the intention to use nursing diagnoses significantly differed among the groups ($p = 0.004$), with first-year students reporting higher intentions compared to third-year students ($p = 0.003$) (Table 2).

Table 2. Differences in students' characteristics and knowledge and their significates among three years of course.

Variable	1° year		2° year		3° year		p-value ^a	p-value ^b
	Mean	SD	Mean	SD	Mean	SD		
PSI* - Engagement	45.65	15.50	41.90	13.86	39.87	13.75	0.006	0.005 1° year > 3° year
PSI* - Self-Assurance	23.38	9.70	22.71	7.64	22.29	8.74	0.613	-
PSI* - Methodical Thinking	11.72	5.61	11.59	4.54	10.52	4.87	0.128	-
PND Scale**	82.43	9.81	85.04	12.80	82.02	9.09	0.075	-
Intention to use nursing diagnoses	8.58	1.70	8.05	1.87	7.73	2.47	0.004	0.003 1° year > 3° year
Level of knowledge	11.68	4.14	12.08	3.63	12.57	3.83	0.192	-

*Problem Solving Inventory; **Position on Nursing Diagnosis; ^aANOVA test between groups; ^bBonferroni post-hoc test.

Correlations with knowledge of the nursing process and SNLs

Pearson's correlations indicated that higher exam grades ($r = 0.178$, $p = 0.001$), intention to use nursing diagnoses ($r = 0.144$, $p = 0.007$), PSI-Self-Assurance ($r = 0.159$, $p = 0.003$), and PSI-Methodical Thinking ($r = 0.127$, $p = 0.0017$) were positively associated with knowledge. Conversely, a larger class size ($r = -0.239$, $p < 0.001$), older age ($r = -0.133$, $p = 0.012$), and male sex ($r = -0.172$, $p =$

0.001) were negatively associated with knowledge.

The final regression model ($R^2 = 0.111$) retained sex, class size, intention to use nursing diagnoses, and PSI-Self-Assurance as variables independently associated with level of knowledge. Specifically, female students ($B = -1.875$, $p = 0.002$), smaller class size ($B = -0.019$, $p = 0.001$), higher intention to use nursing diagnoses ($B = 0.287$, $p = 0.006$), and greater PSI-Self-Assurance ($B = 0.062$, $p = 0.009$) were associated with higher knowledge scores (Table 3).

Table 3. Backward regression ($R^2 = 0.111$).

Predictor	B (SE)	B standardized	t	p-value	95% CI	
					Lower	Upper
Sex*	- 1.875 (0.613)	- 0.164	- 3.081	0.002	- 3.081	- 0.668
Class size	- 0.019 (0.005)	- 0.182	- 0.029	0.001	- 0.029	- 0.008
Intention to use nursing diagnoses	0.287 (0.105)	0.148	0.081	0.006	0.081	0.493
PSI - Self-Assurance	0.062 (0.024)	0.141	0.016	0.009	0.016	0.108

Abbreviations: PSI, Problem Solving Inventory; B, regression coefficient; SE, Standard Error; t, test t; CI, Confidence Interval. Note. * Sex was coded as 1=female and 2= male.

Discussion

Participants' characteristics in the context of nursing education

This study explored nursing students' problem-

solving skills and the relationship between these skills and knowledge of the nursing process and SNLs. The demographic and academic characteristics of the participants were largely consistent with those reported in previous research on nursing education. The participants were relatively young and unmarried, and

the marked predominance of female students reflects the current gender distribution observed in nursing programs in Italy and internationally (Bulfone et al., 2024; Luciani et al., 2020; Ogunmuyiwa et al., 2025; Wan Chik et al., 2012). While this relative homogeneity enhances the internal coherence of the findings, it may limit their generalizability to more gender-balanced or culturally diverse educational contexts.

Most participants reported not combining their studies with paid employment, suggesting a predominantly full-time student population. This characteristic may reduce the potential influence of external demands on academic engagement and learning processes. Similarly, the high proportion of on-site students may indicate more stable learning conditions and greater access to institutional educational resources. Moreover, the heterogeneity in prior educational backgrounds may reflect differences in initial learning approaches and cognitive strategies, which could contribute to variability in problem-solving abilities and knowledge acquisition during undergraduate education. The relatively limited number of self-reported weekly study hours may highlight the central role of experiential and practice-based learning in shaping educational outcomes (Alberti et al., 2021; Esmaeilzadeh & Aygün, 2025; Sayyah et al., 2017).

Educational trends across the nursing program

The findings highlight a complex interplay between individual attributes, learning environments, and motivational factors, consistent with previous research on diagnostic reasoning and competence development in nursing education (Hong et al., 2021). A notable finding is the significant decline, from the first to the third year of study, in both problem-solving engagement and the intention to use nursing diagnoses (Table 2). Similar trends have been reported in nursing programs internationally, in which students' initial enthusiasm tends to decrease as academic demands intensify and clinical workloads increase (Ten Hoeve et al., 2017).

This decline may also reflect students' exposure to clinical settings in which nursing diagnoses and SNLs are applied inconsistently or perceived as having limited practical relevance, which could negatively influence their motivation

to use these tools (Negm et al., 2024). Despite these motivational differences, no significant increase in knowledge levels across academic years was observed. This lack of progression suggests that curricular exposure alone may be insufficient to support the consolidation of diagnostic knowledge unless it is consistently reinforced through clinical practice, simulation, and reflective learning activities. Previous research has similarly emphasized the need for stronger scaffolding of diagnostic reasoning across educational and clinical settings (Sim et al., 2022; Son, 2023).

Contribution of problem-solving skills to knowledge of the nursing process and SNLs

The positive associations found between knowledge levels, academic performance, intention to use nursing diagnoses, and two problem-solving dimensions (self-assurance and methodical thinking) are consistent with evidence indicating that confidence and structured reasoning play a central role in clinical decision making (Hagbaghery et al., 2004; Kim et al., 2019). In particular, PSI-Self-Assurance reflects students' confidence in their perceived ability to manage complex cognitive demands and has been associated with greater engagement with diagnostic reasoning and a higher willingness to address uncertainty (Alrashidi et al., 2023). However, it is important to acknowledge that the PSI measures self-perceived problem-solving ability rather than objective performance. Therefore, these associations should be interpreted cautiously, as higher self-assurance may both facilitate and result from greater knowledge acquisition, suggesting a potentially bidirectional relationship.

Similarly, PSI-Methodical Thinking was positively associated with knowledge levels, reinforcing the importance of systematic and deliberate reasoning processes when learning and applying SNLs. Conversely, a larger class size was significantly and negatively associated with knowledge levels. This finding aligns with educational research suggesting that larger classes may limit opportunities for interaction, feedback, and active learning, which are essential for developing higher-order cognitive skills, such as diagnostic reasoning (Kerns & Wedgeworth, 2024; Lee et al., 2011).

Overall, students who were female, enrolled in

smaller classes, more motivated to use nursing diagnoses, and more self-assured achieved higher knowledge scores. However, these associations should be interpreted with caution, as the model explained only a limited proportion of the variance in knowledge levels ($R^2 = 0.11$), indicating that additional factors may influence this outcome.

In particular, the intention to use nursing diagnoses emerged as one of the variables most strongly associated with knowledge, a finding consistent with the theory of planned behavior, which emphasizes the central role of intention in guiding behavior (Ajzen, 1991). These results are also aligned with motivational and social-cognitive theories suggesting that confidence, intentionality, and self-regulatory processes play a crucial role in shaping learning behaviors and performance in complex professional tasks (Hwang & Oh, 2021; Kukulu et al., 2013; Ramezanzade Tabriz et al., 2024).

Collectively, these findings suggest that diagnostic competence may be influenced by factors beyond curricular exposure and could develop within a broader educational ecosystem that includes classroom dynamics, clinical culture, personal motivation, and students' confidence in their problem-solving abilities. Moreover, the absence of a clear progression in knowledge across academic years highlights the need for improved vertical integration of diagnostic content throughout the curriculum, ensuring greater continuity between theoretical instruction and clinical application.

Implication for nursing education and practice

The results of this study have relevant implications for both nursing education and clinical practice. First, educational strategies should move beyond the traditional focus on content delivery and place greater emphasis on strengthening students' confidence in their problem-solving abilities. Interventions such as simulation-based learning, structured clinical scenarios, and reflective debriefing may help students develop self-assurance and engage more effectively in diagnostic reasoning processes.

Second, fostering a positive attitude and intentional use of nursing diagnoses should be considered a key educational objective. Since intention emerged as a significant factor associated with knowledge, integrating SNLs

consistently across theoretical courses and clinical placements may enhance their perceived relevance and practical applicability.

Third, the negative association between class size and knowledge suggests that more interactive and student-centered learning environments may be beneficial. Small-group activities, case-based discussions, and mentored clinical documentation could provide opportunities for active engagement, feedback, and consolidation of diagnostic reasoning skills.

Finally, stronger integration between academic and clinical settings is essential to ensure the consistent application of SNLs in real-world practice. Clinical mentors and educators should model the use of SNLs and support students in applying the nursing process during clinical training, thereby bridging the gap between theory and practice and promoting more standardized, effective, and patient-centered care.

Study limitations

Some limitations need to be acknowledged. First, this study's observational and cross-sectional nature precludes any causal inference regarding the relationships between problem-solving skills and knowledge of the nursing process and SNLs. Second, data were collected from a single university, which may limit the generalizability of the findings to other educational and cultural contexts. Third, problem-solving skills were assessed using a self-report instrument, which captures the students' perceived abilities rather than their objective performance and may be influenced by response bias or self-evaluation tendencies. Fourth, the students' knowledge questionnaire did not undergo a comprehensive psychometric validation process. Only the instrument development was reported, while evidence regarding its validity, and other psychometric properties was not provided. Therefore, the findings should be interpreted with appropriate caution and considered preliminary pending further validation of the instrument.

Furthermore, the study did not collect detailed information regarding students' actual exposure to the nursing process and SNLs during classroom teaching and clinical placements. Variability in teaching approaches, mentorship, and the practical use of nursing diagnoses across educational and clinical settings may have

influenced knowledge levels independently of the factors examined in this study.

Finally, although several relevant academic and contextual variables were considered, a substantial proportion of the variance in knowledge remains unexplained. This suggests that other individual, instructional, and clinical factors not examined in this study may play an important role.

Conclusions

This study contributes to the growing body of nursing education research by providing empirical evidence on the relationship between nursing students' problem-solving skills and their level of knowledge of the nursing process and SNLs. The findings suggest that SNL knowledge may be associated with the cognitive and motivational dimensions of problem solving, particularly self-assurance and methodical thinking. In addition, students' intention to use nursing diagnoses and contextual factors, such as class size emerged as relevant elements shaping diagnostic knowledge.

The absence of significant differences in knowledge levels across academic years highlights a potential gap in the progressive reinforcement of diagnostic reasoning throughout undergraduate nursing education. This finding emphasizes the need for stronger curricular integration between theoretical instruction on the nursing process and its consistent application in clinical and simulation-based learning environments. Educational strategies that foster students' confidence, intentional engagement with nursing diagnoses, and structured reasoning processes may therefore play a key role in strengthening diagnostic competence and problem-oriented thinking.

Future research should adopt longitudinal and experimental designs to evaluate targeted educational interventions, combining objective and self-reported measures for a more comprehensive assessment. Additionally, multicenter, cross-cultural samples should be included to improve the generalizability of findings and deepen the understanding of diagnostic reasoning development in nursing students.

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