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COMPETÊNCIAS CLÍNICAS DOS ESTUDANTES DE LICENCIATURA EM ENFERMAGEM NOS ENSINOS CLÍNICOS
CLINICAL SKILLS OF UNDERGRADUATE NURSING STUDENTS IN CLINICAL TRAINING
COMPETENCIAS CLÍNICAS DE LOS ESTUDIANTES DE LICENCIATURA EN ENFERMERÍA EN LA FORMACIÓN CLÍNICA

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RESUMO

Introdução: A formação dos estudantes em contexto clínico assume um papel determinante na consolidação das suas competências, sendo essencial identificar e avaliar as competências ao longo do ensino de forma a melhorar o processo formativo de ensino/aprendizagem e, em articulação, os cuidados de saúde.
Objetivo: Avaliar as competências clínicas em estudantes de licenciatura em enfermagem e analisar a influência das variáveis sociodemográficas sobre essas competências.
Métodos: Estudo de natureza quantitativa, descritivo e exploratório, cujo objetivo é avaliar a competência clínica de estudantes de enfermagem em contexto de ensino clínico. Foi aplicado o *Clinical Competence Questionnaire* (CCQ), instrumento validado e adaptado à população portuguesa, que permite medir os níveis de competência clínica em múltiplas dimensões fundamentais à prática profissional. A amostra foi constituída por 251 estudantes da licenciatura em enfermagem, provenientes de três Escolas de Enfermagem da região de Lisboa e Vale do Tejo, integradas no setores público e privado. O estudo obteve parecer favorável das Comissões de Ética das instituições envolvidas.
Resultados: Os resultados sugerem que os estudantes de enfermagem apresentam maior competência nos comportamentos profissionais e no desempenho geral, enquanto as competências nucleares e avançadas registam valores mais baixos, especialmente em procedimentos técnicos mais específicos.
Conclusão: Este estudo evidencia um padrão de evolução no desenvolvimento das competências clínicas ao longo da formação académica, com limitações para a organização dos ensinos clínicos e para as estratégias pedagógicas em enfermagem.

Palavras-chave: estudantes de enfermagem; competência clínica; ensino clínico; educação em enfermagem

ABSTRACT

Introduction: The training of students in a clinical context plays a decisive role in consolidating their skills. It is essential to identify and assess skills throughout the teaching process in order to improve the teaching/learning process and, in conjunction with this, healthcare.
Objective: To assess clinical competencies in undergraduate nursing students and to analyze the influence of sociodemographic variables on these competencies.
Methods: A quantitative, descriptive, and exploratory study aimed at evaluating the clinical competence of nursing students in a clinical education context. The Clinical Competence Questionnaire (CCQ) was applied, a validated instrument adapted to the Portuguese population, which allows the measurement of levels of clinical competence across multiple dimensions fundamental to professional practice. The sample consisted of 251 undergraduate nursing students from three Nursing Schools in the Lisbon and Tagus Valley region, belonging to both the public and private sectors. The study received favorable approval from the Ethics Committees of the participating institutions.
Results: The results suggest that nursing students demonstrate higher competence in professional behaviors and overall performance, whereas core and advanced competencies show lower scores, particularly in more specific technical procedures.
Conclusion: This study highlights a pattern of progression in the development of clinical competencies throughout academic training, while also identifying limitations related to the organization of clinical education and pedagogical strategies in Nursing.

Keywords: nursing students; clinical competence; clinical education; nursing education

RESUMEN

Introducción: La formación de los estudiantes en el contexto clínico desempeña un papel determinante en la consolidación de sus competencias, por lo que es esencial identificar y evaluar dichas competencias a lo largo de la enseñanza con el fin de mejorar el proceso formativo de enseñanza/aprendizaje y, en consecuencia, la atención sanitaria.
Objetivo: Evaluar las competencias clínicas en estudiantes de grado en enfermería y analizar la influencia de las variables sociodemográficas sobre dichas competencias.
Métodos: Estudio de carácter cuantitativo, descriptivo y exploratorio, cuyo objetivo es evaluar la competencia clínica de estudiantes de enfermería en un contexto de enseñanza clínica. Se aplicó el *Clinical Competence Questionnaire* (CCQ), un instrumento validado y adaptado a la población portuguesa, que permite medir los niveles de competencia clínica en múltiples dimensiones fundamentales para la práctica profesional. La muestra estuvo compuesta por 251 estudiantes del grado en Enfermería, procedentes de tres Escuelas de Enfermería de la región de Lisboa y Valle del Tajo, pertenecientes a los sectores público y privado. El estudio obtuvo la aprobación favorable de los Comités de Ética de las instituciones participantes.
Resultados: Los resultados sugieren que los estudiantes de Enfermería presentan una mayor competencia en los comportamientos profesionales y en el desempeño general, mientras que las competencias nucleares y avanzadas muestran valores más bajos, especialmente en procedimientos técnicos más específicos.
Conclusión: Este estudio pone de manifiesto un patrón de evolución en el desarrollo de las competencias clínicas a lo largo de la formación académica, así como limitaciones relacionadas con la organización de las prácticas clínicas y las estrategias pedagógicas en enfermería.

Palabras clave: estudiantes de enfermería; competencia clínica; educación clínica; educación en enfermería

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INTRODUCTION

In recent years, nursing education in Portugal has undergone significant changes, reflecting the need to align academic training with the demands of clinical practice. Training students in a clinical setting plays a crucial role in consolidating their skills, making it essential to ensure that, throughout their undergraduate studies, they acquire the necessary capabilities to provide safe and quality care (Albloushi et al., 2023; Immonen et al., 2019). The assessment of clinical competencies in clinical education has been one of the challenges in nursing training, as it involves multiple domains, from theoretical knowledge to decision-making ability and clinical judgment (Cantante et al., 2020).

Despite acknowledging the importance of developing clinical competencies, gaps remain in the literature regarding the systematic assessment of these competencies in undergraduate nursing students, particularly in the Portuguese context and based on its sociodemographic characteristics. Identifying these competencies and the factors that influence them proves essential to support the definition of pedagogical strategies and clinical supervision models better suited to the current needs of students. In this context, the present study aims to assess the clinical competencies of undergraduate nursing students and analyze the influence of sociodemographic variables on these competencies, contributing to a deeper understanding of the process of developing clinical skills throughout academic training. The assessment of clinical competencies thus constitutes a central element in facilitating the transition to professional practice, promoting a safer, more autonomous, and confident integration of future nurses into the labor market.

1. THEORETICAL FRAMEWORK

The concept of competence has been widely debated in the literature, with different approaches to its definition and assessment. According to Cantante et al. (2020, p. 267), the competence of the general care nurse refers to "a level of professional performance that demonstrates the effective application of knowledge and skills, enabling clinical judgment and decision-making." Complementarily, the Order of Nurses (OE, 2017) states that the competency profile of the general care nurse is structured into three main domains: professional, ethical, and legal responsibility; care delivery and management; and professional development. These domains reflect the complexity of nursing practice and the need to prepare students to face the challenges of practice with autonomy and safety.

The transition from theoretical learning to clinical practice is a dynamic process that requires clinical teaching spaces to be structured to provide meaningful, reflective, and integrative experiences. Mahboob (2019) emphasizes that the quality of clinical teaching depends on creating opportunities for sharing experiences, developing projects that address emerging questions, and the continuous integration of theoretical knowledge with care practice. Berndtsson, Dahlborg, and Pennbrant (2019) state that learning in a clinical context allows students to integrate theoretical frameworks into care, enabling them to develop practical skills and knowledge. The integration of theoretical frameworks with clinical practice is essential for the development of nursing students' competencies, allowing them to gradually progress toward autonomy and decision-making ability. To understand this process of transition and the development of clinical competencies, one of the most widely used models is that of Patricia Benner (2001). This model describes five levels of development: initiated, advanced beginner, competent, proficient, and expert; showing that students start by needing clear rules and structures, progressively developing greater autonomy and clinical judgment as they accumulate competence. Given the complexity of developing clinical skills, it becomes essential to use valid and reliable instruments that allow the assessment of students' progress throughout their academic training. The Clinical Competence Questionnaire, developed by Liou & Cheng (2014), is a self-assessment tool that measures students' perceptions of their clinical competencies in different areas of professional practice. In the present study, the Portuguese version of the instrument, called the Clinical Competence Questionnaire (QCC), which had previously been adapted and validated for the Portuguese population, was used, allowing the assessment of essential dimensions of the professional performance of nursing students, namely professional behaviors, overall performance, core competencies, and advanced nursing skills. These dimensions are aligned with the competency domains of the General Care Nurse defined by the Portuguese Nursing Association (OE, 2017), ensuring conceptual consistency between the theoretical framework, the instrument used, and the objectives of the study.

2. METHODS

A quantitative study was conducted, with a descriptive and exploratory design, aiming to assess clinical competence in undergraduate nursing students in a clinical teaching context. The evaluation was carried out through the application of the Clinical Competence Questionnaire (CCQ), a validated instrument adapted to the Portuguese population, which allows measuring levels of clinical competence across multiple dimensions fundamental to professional practice. The Portuguese version of the Clinical Competence Questionnaire (CCQ) was used, culturally adapted, and validated for nursing students in Portugal by Oliveira, Barroso, and Carvalho (2025), which demonstrated good psychometric properties, namely content validity, construct validity, and high internal consistency (overall Cronbach's $\alpha > 0.90$). The sample consisted of 251 undergraduate nursing students enrolled in the 2024-2025 academic year, from three Schools of Nursing of Lisbon and the Tagus Valley region, integrated into institutions in the public and private sectors. Data collection took place between May 1 and November 15, 2024, a period coinciding with the

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completion of clinical teaching in various practice settings. The study was approved by the Ethics Committees of the participating institutions (opinions nº: 1097/2024 and nº 97/2024) and conducted in accordance with the ethical principles of research on human beings, namely the principles of autonomy, beneficence, non-maleficence, and justice, in accordance with the Declaration of Helsinki. Participation was voluntary, through the signing of the Informed Consent Form, after reading and understanding the study's explanatory note. Data were collected on paper, using a standardized procedure that ensured the anonymity and confidentiality of participants. Each student received a set of documents consisting of an explanatory note, two copies of the form of informed consent (one for signed return and another for the participant) and the CCQ questionnaire. After completion, the questionnaires were returned in sealed envelopes and deposited in a pre-defined location at each institution, ensuring the security and integrity of the collected information. The sample size calculation was carried out based on the formula for finite populations, considering a 95% confidence level (Z = 1.96), a 5% margin of error, and an expected proportion of 50% to maximize the sample size. A 10% margin was added to this value to account for potential losses or non-responses, estimating a minimum number of 246 participants. The final sample, composed of 251 students, proved adequate to ensure the robustness of the statistical analysis. The statistical analysis was performed using Jamovi® software, applying both descriptive and inferential analyses. Descriptive statistics included the calculation of frequencies, measures of central tendency (mean and median) and dispersion (standard deviation and interquartile range). The normality of the data distribution was assessed through the Kolmogorov-Smirnov and Shapiro-Wilk tests, as well as by analyzing the skewness and kurtosis coefficients. Given the absence of a normal distribution, non-parametric tests were used. To compare the levels of clinical competence according to gender and academic year, the Kruskal-Wallis test was applied. The association between age and levels of clinical competence was analyzed using Spearman's correlation. A significance level of 0.05 was considered, with the results interpreted in light of this criterion.

3. RESULTS

This study presents the results obtained from the application of the Clinical Competence Questionnaire (CCQ) to a sample of 251 undergraduate nursing students. The data analysis is organized into three sections: (i) sociodemographic characterization of the sample; (ii) assessment of students' clinical competencies, according to the four dimensions of the CCQ; and (iii) analysis of the influence of sociodemographic variables (gender, academic year, and age) on perceived clinical competencies.

3.1. Sociodemographic Characterization of the Sample

The sample consisted of 251 undergraduate nursing students from three Nursing Schools in the Lisbon and Tagus Valley region, part of public and private sector institutions. The sociodemographic characteristics of the sample are presented in Tables 1 and 2. The majority of participants were female (80%), reflecting the predominance of women in the nursing field. Regarding the academic year, there was a higher representation of third-year students (31.47%), followed by second-year students (27.09%) and fourth-year students (21.93%).

Regarding age, the sample is characterized as predominantly young, with 82.47% of students between 18 and 25 years old, mainly corresponding to Generation Z. This age profile is consistent with the typical academic path of a nursing degree.

Table 1 – Distribution by gender and year of study

Gender	Ano de curso	N	%
Female	2nd year	68	27,09
	3rd year	79	31,47
	4th year	55	21,93
Male	2nd year	18	7,17
	3rd year	14	5,58
	4th year	13	5,18
Other	2nd year	1	0,40
	3rd year	2	0,80
	4th year	1	0,40

Note: N = Absolute number; % = Relative number.

Table 2 – Distribution by Age range of the students

Age range of the students	N	%
18-20 years old	86	34,26
21-25 years old	121	48,21
26-30 years old	16	6,37
31-55 years old	28	11,16

Note: N = N = Absolute number; % = Relative number.

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3.2 Clinical Competencies in Nursing Students

The assessment of clinical competencies was carried out through the Clinical Competencies Questionnaire (CCQ), considering the four dimensions that constitute it: professional nursing behaviors, overall performance, core competencies, and advanced nursing competencies. The distribution of perceived clinical competency levels by dimension is presented in Table 3. Overall, students showed higher levels of competence in professional behaviors and overall performance, dimensions associated with ethics, professional responsibility, work organization, and basic nursing care. These results suggest a greater consolidation of these competencies throughout clinical training. In contrast, core competencies and, especially, advanced nursing competencies showed lower levels of perceived competence, particularly in procedures of higher technical complexity and clinical demand. This pattern indicates that these skills tend to be acquired more gradually, being heavily dependent on clinical exposure, practical experience, and progression throughout the course.

Table 3 - Clinical competence perceived by students according to the dimensions of the CCQ

Dimension of CCQ	n	M	SD	Mín.	Máx.
Professional nursing behaviors	251	4,32	0,41	2,75	5,00
Overall performance	251	3,98	0,52	2,17	5,00
Core nursing competencies	251	3,46	0,63	1,92	5,00
Advanced nursing skills	251	2,89	0,71	1,00	4,83
Overall clinical competence	251	3,66	0,48	2,08	4,91

Note: N = absolute frequency; M = Mean; SD = Standard deviation; Min. = Minimum; Max. = Maximum.

3.3 Influence of sociodemographic variables (inferential analysis)

The influence of sociodemographic variables on perceived levels of clinical competence was analyzed using non-parametric statistical tests. Differences based on gender and year of study were explored, as well as the association between age and nursing students' clinical competencies. Considering the length of the instrument and aiming to ensure greater clarity and conciseness in presenting the results, only the indicators and items that showed statistically significant differences or associations are presented below. Regarding gender, the results shown in Table 4 indicate that, overall, no statistically significant differences were observed in perceived levels of clinical competence between female and male students ($p > 0.05$). Although some individual items revealed statistically significant differences, the overall test value confirms that gender is not a determining factor in the development of clinical competencies perceived by students. In contrast, the academic year was found to have a statistically significant influence on clinical competency levels (Table 5). A progressive increase in competency levels was observed as students advanced through the course, with this trend being particularly evident in dimensions related to overall performance, core competencies, and advanced nursing competencies. The overall test value ($H = 37.400$; $p < 0.001$) confirms that academic progression and greater exposure to the clinical setting significantly contribute to the development of clinical competencies. Regarding age, the association between this variable and clinical competencies is presented in Table 6. Spearman correlation analysis showed a moderate and statistically significant positive association between age and overall clinical competencies ($r_s = 0.337$; $p < 0.001$). This association was particularly evident in technical and advanced skills, suggesting that factors such as maturity, prior experiences, and longer clinical exposure are associated with higher levels of perceived competence. However, not all skills showed a statistically significant correlation with age, indicating that the impact of this variable varies depending on the specific domain of the clinical skills assessed.

Table 4 - Kruskal-Wallis test of the association between gender and clinical skills (summary)

Indicator	H	df	p
Total (CCQ)	2.030	2	0.363
Item 17 – Collection of medical history data in new admissions	6.922	2	0.031
Item 38 – Urinary catheter insertion and related care	7.999	2	0.018

Note: H = Kruskal-Wallis; df = degrees of freedom; p = level of statistical significance.

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Table 5 - Kruskal-Wallis test of the association between academic year and clinical competencies (summary)

Indicator	H	df	p
Total (CCQ)	37.400	2	< 0.001
Item 23 – Shift change	32.082	2	< 0.001
Item 27 – I assess the elimination	42.375	2	< 0.001
Item 30 – Venipuncture	38.642	2	< 0.001
Item 31 – I prepare intravenous injectables	39.326	2	< 0.001
Item 32 – IV bag/bottle change	68.470	2	< 0.001
Item 37 – Transfusions	45.971	2	< 0.001
Item 46 – Chest drain (water seal)	21.025	2	< 0.001

Note: H = Kruskal-Wallis; df = degrees of freedom; p = level of statistical significance.

Table 6 - Spearman correlation between age and clinical skills

Indicator	r_s	df	p
Total (CCQ)	0.337	249	< 0.001
Item 34 – Intramuscular medication	0.360	249	< 0.001
Item 37 – Transfusions	0.369	249	< 0.001
Item 40 – Postural drainage/percussion/oxygen therapy	0.330	249	< 0.001
Item 41 – Preoperative and postoperative care	0.347	249	< 0.001
Item 44 – Care for tracheostomies	0.360	249	< 0.001
Item 46 – Chest drain (water seal)	0.370	249	< 0.001

Note: r_s = Spearman correlation coefficient; *df* = degrees of freedom; *p* = level of statistical significance.

4. DISCUSSION

The assessment of nursing students' clinical competencies, carried out through the QCC, revealed differing levels of proficiency across the various dimensions analyzed. The results of this study suggest that nursing students show greater competence in professional behaviors and overall performance, while core and advanced competencies register lower levels, especially in more specific technical procedures. This pattern reflects a progressive consolidation of relational, ethical, and organizational skills, contrasting with greater difficulties in more complex technical competencies, which aligns with findings from previous studies emphasizing the importance of continuous practical exposure in the development of clinical competencies (Benner, 2001).

The sociodemographic analysis revealed that the majority of students belong to Generation Z (82.47% are between 18 and 25 years old). Studies indicate that this generation, strongly influenced by technology, values emotional, financial, and physical security but may face difficulties in developing interpersonal skills and managing professional autonomy (Lee et al., 2023; Luukkonen et al., 2023). These characteristics may influence the way students engage in clinical settings, highlighting the need for innovative pedagogical methodologies that promote motivation, interaction, and adaptation to the new dynamics of clinical education (Lennon et al., 2020).

Professional behaviors were the dimension with the best results, particularly standing out were the adherence to the ethical principles of secrecy and confidentiality, and the maintenance of an appropriate appearance. This result suggests an early internalization of the ethical and deontological values of the profession, possibly due to the emphasis given to these topics in the course curriculum structure, combined with the influence of clinical supervision during the initial clinical teachings (Albendin-Garcia et al., 2023).

However, lower levels of competence were observed in items that require critical thinking, problem-solving, and effective interprofessional communication. These weaknesses are consistent with the literature, which identifies these skills as particularly demanding from a cognitive and relational standpoint, and often less developed in the early stages of clinical education (Foronda et al., 2020; Lee et al., 2023; Scheckel et al., 2023).

In overall performance, students demonstrated greater competence in everyday direct care tasks, particularly those related to basic care and continuity of care. These skills tend to be more frequently trained and reinforced in early clinical settings, which explains the higher levels of proficiency observed (Reeve et al., 2021; Zyond et al., 2022). Conversely, weaknesses were evident in activities requiring structured therapeutic communication and clinical documentation, suggesting limited clinical autonomy, reflecting challenges in transitioning from theoretical knowledge to its application in real care settings (Papathanasiou et al., 2019; Valizadeh et al., 2019).

Core competencies showed significant variability. Stronger performance was observed in more frequent and routine technical procedures, whereas competencies associated with invasive or less common procedures in a clinical context demonstrated lower levels of perceived competence. The lower exposure to these practices in real clinical settings may explain these results, highlighting the need to reinforce supervised training and the use of complementary methodologies (Said & El-Shafei, 2020). In this regard, clinical simulation emerges as a particularly relevant educational strategy, especially in low-frequency procedures in

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current clinical practice (Cant & Cooper, 2017). The dimension of advanced competencies showed the lowest results in clinical competence. This finding reinforces the idea that students have limited access to practical experiences in more complex clinical settings, which is consistent with studies that point to barriers in accessing these practices, as well as limitations in the available supervision resources (Uncu & Gunes, 2021).

It is also important to emphasize that the development of these skills requires the integration of clinical decision-making, risk anticipation, and time management, aspects that tend to become consolidated only with continued clinical experience (Mancin et al., 2024; Marques et al., 2021; Rogers et al., 2025; Yoong et al., 2023).

The results show a progressive pattern of skills acquisition, beginning in ethical and relational areas and advancing, with less consistency, to technical and more complex skills. This progression is consistent with Benner's (2001) model, which describes the evolution of clinical performance from the novice level to the expert level, through practical experience and the learning context.

Inferential analysis revealed that students' academic progress and age positively influence the development of clinical skills. The year of study stood out as the variable with the greatest impact, reflecting the importance of progressive and cumulative exposure to clinical teaching contexts. These findings are consistent with studies suggesting that experience, maturity, and self-regulation capacity influence clinical performance (Silva et al., 2022; Vasconcelos et al., 2019).

Regarding gender, the results indicated no statistically significant differences in overall clinical skills, suggesting that gender is not a relevant differentiating factor in clinical performance. The occasional differences observed in certain skills may reflect contextual variations related to clinical practice opportunities rather than factors intrinsic to gender, which is consistent with recent studies pointing to increasing gender equity in nursing education (Pérez-Cañaveras et al., 2021).

In turn, age showed a moderate positive correlation with clinical skills, especially in technical and advanced competencies. This result suggests that older students tend to exhibit higher levels of performance, possibly associated with greater maturity, prior experiences, and critical thinking ability (Currie et al., 2022; Liou et al., 2020). This finding reinforces the importance of differentiated pedagogical strategies that take into account the age heterogeneity of the student population.

The results of this study support the need for the adoption of integrated pedagogical strategies, highlighting the use of clinical simulation, the construction of reflective portfolios, and the implementation of structured supervisory processes as facilitators of clinical development (Cant & Cooper, 2017; Choi & Jeon, 2022; Peddle et al., 2019). Considering sociodemographic variables in the organization of clinical teaching is a key element for a more balanced and effective training, reinforcing the connection between theoretical teaching and clinical practice and promoting a safe transition from knowledge to know-how.

5. STUDY LIMITATIONS

This study has some limitations that should be considered when interpreting the results. First, it is a cross-sectional study, which prevents establishing causal relationships and limits the understanding of the development of clinical competencies over time. Second, the assessment of clinical competencies was based on a self-report instrument, which may be subject to biases associated with students' individual perceptions, such as social desirability or overestimation of their own abilities. Additionally, the sample consisted of undergraduate nursing students from three institutions in the Lisbon and Tagus Valley region, which may limit the generalization of the results to other geographic or institutional contexts. Despite these limitations, the sample size and the use of a validated instrument provide robustness to the results obtained.

CONCLUSION

This study allowed for an in-depth analysis of the clinical competencies self-perceived by nursing students, highlighting a pattern of progressive development throughout their academic training. The results showed higher levels of competence in the dimensions of professional behaviors and overall performance, contrasting with lower values in technical and advanced skills, particularly in more complex procedures. These gaps appear to reflect the clinical development stage of the students, as well as their limited practical exposure to certain specialized interventions during initial training. The analysis of the different dimensions revealed an early internalization of ethical and professional values, suggesting that these constitute a central framework of nursing education. In contrast, competencies related to critical thinking, problem-solving, and interprofessional communication were less consolidated, which underscores the need for educational strategies that promote clinical reasoning, decision-making, and the integration of theoretical knowledge into clinical practice.

Regarding sociodemographic variables, it was found that the year of study and age have a significant influence on the development of clinical competencies. Progression throughout the academic course was associated with higher levels of competence, particularly in the core and advanced dimensions, highlighting the positive impact of accumulated clinical experience. Similarly, the positive association between age and more complex competencies suggests that factors such as maturity, previous experiences, and greater self-regulation capacity can enhance clinical performance.

Together, these results highlight the need to strengthen differentiated and student-centered pedagogical strategies, emphasizing active methodologies that promote the integration of theoretical teaching and clinical practice. Adapting training processes to the

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sociodemographic characteristics of students is seen as a fundamental element to ensure education balanced, fair, and effective, capable of supporting a safe, autonomous, and competent transition to professional nursing practice.

AUTHORS´ CONTRIBUTION

Conceptualization, P.O., C.B., and A.C.; data curation, P.O., C.B., and A.C.; formal analysis, P.O., C.B., and A.C.; investigation, P.O., C.B., and A.C.; methodology, P.O., C.B., and A.C.; project administration, P.O., C.B., and A.C.; resources, P.O., C.B., and A.C.; software, P.O., C.B., and A.C.; supervision, C.B., and A.C.; validation, P.O., C.B., and A.C.; visualization, P.O., C.B., and A.C.; writing—original draft preparation, P.O., C.B., and A.C.; writing—review and editing, P.O., C.B., and A.C.

CONFLICT OF INTERESTS

The authors declare no conflict of interest.

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