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Influence of AI use on the managerial skills of nursing students

Influencia del uso de IA en competencias gerenciales de estudiantes de Enfermería

Juan Leonardo Pacios Dorado[1], Miguel Enrique Barroso Fontanals[2], Raiza Fernández Sosa[3]

[1]Universidad de Ciencias Médicas Santiago de Cuba, Filial de Ciencias Médicas "Julio Trigo López", Palma Soriano, Santiago de Cuba, Cuba.
[2]Universidad de Ciencias Médicas Santiago de Cuba, Facultad de Medicina No.2, Santiago de Cuba, Cuba.
[3]Universidad de Ciencias Médicas Santiago de Cuba, Filial de Ciencias Médicas "Julio Trigo López", Departamento de Extensión Universitaria, Palma Soriano, Santiago de Cuba, Cuba.

Corresponding author: Juan Leonardo Pacios Dorado

ABSTRACT

This study analyzes the influence of the use of Artificial Intelligence tools on the development of managerial competencies in undergraduate Nursing students in Cuba. An observational, cross-sectional, and quantitative study was conducted on a stratified sample of 367 students from the country's Universities and Faculties of Medical Sciences. The results revealed a significant positive correlation (r=0,61) between the level of Artificial Intelligence use and the mastery of managerial competencies, particularly in decision-making. However, notable inter-institutional disparities were identified, revealing gaps in access and the effectiveness of technology integration, as well as a perception of self-efficacy that was lower than the favorable attitude towards Artificial Intelligence. It is concluded that Artificial Intelligence is a valuable resource for managerial training in Nursing, but realizing its potential requires differentiated and equitable pedagogical implementation strategies that go beyond mere access to technology and strengthen the competency confidence of future professionals.

Keywords: Artificial Intelligence; Nursing; Students; Undergraduate; Health Management; Management Competencies; Education; Nursing; Cuba.

RESUMEN

El presente trabajo analiza la influencia del uso de herramientas de Inteligencia Artificial en el desarrollo de competencias gerenciales en estudiantes de pregrado de Enfermería en Cuba. Se realizó un estudio observacional, transversal y cuantitativo en una muestra estratificada de 367 estudiantes de las Universidades y Facultades de Ciencias Médicas del país. Los resultados revelaron una correlación positiva y significativa (r=0,61) entre el nivel de uso de Inteligencia Artificial y el dominio de competencias gerenciales, especialmente en la toma de decisiones. No obstante, se identificaron disparidades interinstitucionales notables, con brechas en el acceso y la efectividad de la integración tecnológica, así como una percepción de autoeficacia inferior a la actitud favorable hacia la Inteligencia Artificial. Se concluye que la Inteligencia Artificial constituye un recurso valioso para la formación gerencial en Enfermería, pero su potencial exige estrategias de implementación pedagógica diferenciadas y equitativas que trasciendan el mero acceso a la tecnología y fortalezcan la confianza competencial de los

futuros profesionales.

Palabras clave: Inteligencia Artificial; Enfermería; Estudiantes de Pregrado; Gestión en Salud; Competencias Gerenciales; Educación en Enfermería; Cuba.

INTRODUCTION

Healthcare management in the global arena of the 21st century is unfolding in an increasingly complex environment, characterized by growing healthcare demands, financial constraints, and rapid digital transformation.[1] This landscape requires reconfiguring training models for healthcare professionals, who must be prepared not only to provide excellent clinical care but also to assume management and leadership roles that ensure the efficiency, quality, and sustainability of services. Within this professional spectrum, nursing occupies a strategic position. Nursing staff are the backbone of the healthcare system, and their practice is intrinsically linked to care management. This process involves planning, organizing, directing, and controlling resources to ensure comprehensive patient care.[2]

Digital Transformation (DT) is consolidating as a cross-cutting, unstoppable force in this evolution, redefining both clinical and administrative processes.[3] Among the most disruptive technologies of this era is Artificial Intelligence (AI), defined as the branch of computer science that develops systems and software capable of performing tasks that usually require human intelligence, such as learning, reasoning, and problem solving.[4] Its incursion into the healthcare sector is multidimensional, spanning computer-assisted diagnostic imaging, outbreak prediction, and hospital workflow optimization.[5]

In higher education, AI has emerged as a catalyst for pedagogical innovation.[6] Adaptive learning platforms, intelligent tutoring systems, educational chatbots, and advanced virtual simulators are demonstrating their potential to personalize teaching, facilitate the acquisition of complex skills, and free up teaching time for higher value-added activities.[7] In medical and nursing education, its application has been predominantly associated with improving technical and clinical reasoning skills through immersive, high-fidelity virtual case simulation.

However, a comprehensive review of the current scientific literature identifies a critical knowledge gap. There is a significant shortage of research that specifically and quantitatively examines AI tools' ability to develop and enhance managerial skills in undergraduate nursing students. While evidence is accumulating in favor of its clinical benefits, its role as a facilitator of management skills—such as human and material resource management, strategic decision-making under uncertainty, leadership of interdisciplinary teams, and implementation of continuous improvement models—remains largely unexplored.[8] This omission is particularly relevant given that the effectiveness of health systems depends to a large extent on the managerial capacity of their frontline professionals, including nurses.

This gap is even more pronounced in specific socioeconomic contexts, such as Cuba and its network of Medical Sciences Universities (UCM). The Cuban health system, internationally recognized for its universal coverage and primary care approach, faces the dual challenge of preserving its social achievements while adapting to economic constraints and selectively incorporating technological innovations. In this scenario, integrating AI into nursing curricula is not a luxury but a potential strategy to strengthen the training of highly skilled, resilient care managers capable of optimizing scarce resources without compromising quality.[9]

Therefore, answering the research question "What is the influence of the use of Artificial Intelligence tools on the development of managerial skills of undergraduate nursing students in Cuba?" becomes an academic and practical imperative. Elucidating this relationship has multifaceted relevance: from a scientific point of view, it would contribute to the construction of a theoretical-practical framework on digital pedagogy in nursing; technologically, it would guide the development or adaptation of AI tools relevant to the Latin American context; and socially, it would contribute to the formation of a better-prepared nursing workforce, which would directly impact the strength and sustainability of the public health system.

Consequently, this study aims to analyze the relationship between the level of use of Artificial Intelligence tools and the development of managerial skills among undergraduate students in the Bachelor of Nursing program at the University of Medical Sciences in Cuba.

METHOD

Study design

An observational, cross-sectional, and analytical study with a quantitative approach was conducted.

Population, sample, and setting

The study universe comprised all 3rd-, 4th-, and 5th-year students enrolled in the Bachelor of Nursing program in the 2024 academic year at the 13 Universities of Medical Sciences (UCM) and the 3 Faculties of Medical Sciences (FCM) in Cuba. The distribution of the population by institution was as follows:

- UCM: Havana (UCMH), Villa Clara (UCM-VC), Santiago de Cuba (UCM-SC), Camagüey (UCM-C), Holguín (UCM-H), Cienfuegos (UCM-Cfg), Matanzas (UCM-Mtz), Pinar del Río (UCM-PR), Ciego de Ávila (UCM-CA), Las Tunas (UCM-LT), Granma (UCM-G), Guantánamo (UCM-Gtmo), Sancti Spíritus (UCM-SS).
- FCM: Mayabeque (FCM-May), Artemisa (FCM-Art), Isla de la Juventud (FCM-IJ).

The sample size was calculated using the finite population correction, yielding a sample of 367 students. The selection was made using stratified probability sampling by institution and academic year, with proportional allocation to the population size in each stratum.

Interventions and instruments

An anonymous, self-administered questionnaire validated by expert judgment (Cronbach's alpha = 0,87) was administered. The instrument assessed sociodemographic variables, the AI Tool Use Frequency Scale, the Nursing Management Competence Scale, and the Self-Efficacy and Attitude toward AI Scale.

Ethical considerations

The study adhered to the ethical principles of the Declaration of Helsinki. Anonymity and data confidentiality were guaranteed. Participation was voluntary and did not entail any compensation.

Statistical analysis

Data processing was performed using IBM SPSS Statistics software, version 28.0. Descriptive statistics (frequencies, percentages, means, and standard deviation) were used to characterize the sample and scales. For inferential analysis, the Chi-square (x^2) test was used to evaluate

associations between categorical variables, Pearson›s correlation coefficient (r) was used to quantify the linear relationship between the main quantitative variables, and a one-way analysis of variance (ANOVA) was used to compare the means of managerial competencies between different academic years. A statistical significance level of $p < 0,05$ was established.[10]

RESULTS

The results of the sample distribution confirmed a proportional representation of the 16 training institutions in the country, with a higher concentration in the Universities of Medical Sciences of Havana (11,44 %), Villa Clara (9,26 %), and Santiago de Cuba (8,72 %), which is consistent with the size of their student population. The Faculties of Medical Sciences (FCM) of Mayabeque, Artemisa, and especially Isla de la Juventud had the smallest sample sizes (1,63 %), reflecting their lower enrollment bases.

In discussing these results, it is evident that the methodological design achieved robust representativeness at the national level, providing a solid basis for subsequent analyses and inter-institutional comparisons and reflecting the reality of the entire territory, thereby strengthening the external validity of the study.[11]

Table 7.1. Sociodemographic Characterization of the Sample (n=367)

Institution	3rd Year (n)	4th Year (n)	5th Year (n)	Total (n)	Percentage
UCM Havana	15	14	13	42	11,44
UCM Villa Clara	12	11	11	34	9,26
UCM Santiago de Cuba	11	11	10	32	8,72
UCM Camagüey	10	10	9	29	7,90
UCM Holguín	10	9	9	28	7,63
UCM Cienfuegos	9	9	8	26	7,08
UCM Matanzas	9	8	8	25	6,81
UCM Pinar del Río	8	8	7	23	6,27
UCM Ciego de Ávila	7	7	7	21	5,72
UCM Las Tunas	7	7	6	20	5,45
UCM Granma	7	6	6	19	5,18
UCM Guantánamo	6	6	6	18	4,90
UCM Sancti Spíritus	6	6	5	17	4,63
FCM Mayabeque	5	5	5	15	4,09
FCM Artemisa	5	5	4	14	3,81
FCM Isla de la Juventud	2	2	2	6	1,63
TOTAL	128	123	116	367	100

The breakdown by institution revealed marked heterogeneity in the use of AI and the development of managerial skills. Institutions such as UCM Villa Clara (3,45 % in AI use; 4,12 % in skills) and UCM Havana (3,38 %; 4,02 %) showed the highest averages. In contrast, FCM Isla de la Juventud (2,17 %; 2,91 %) and UCM Guantánamo (2,22 %; 2,98 %) had the lowest values.

When discussing this disparity, a clear pattern emerges suggesting that UCMs with greater

resources and located in scientific development hubs (in the center-east of the country) are achieving more effective integration.[12] This gap is not only technological but also in learning outcomes, indicating that unequal access to technology and to teacher training programs in pedagogical innovation is translating into unequal preparation for future nursing managers, a critical finding for national educational planning.[13]

Table 7.2. Level of AI Use and Management Competence by Institution

Institution	Average AI Use (1-5)	Overall Management Competence (1-5)
UCM Villa Clara	3,45	4,12
UCM Havana	3,38	4,02
UCM Cienfuegos	3,23	3,89
UCM Holguín	3,14	3,81
UCM Camagüey	3,02	3,75
UCM Santiago de Cuba	2,94	3,64
UCM Matanzas	2,88	3,58
UCM Sancti Spíritus	2,82	3,52
UCM Pinar del Río	2,78	3,47
UCM Ciego de Ávila	2,71	3,41
FCM Mayabeque	2,67	3,33
UCM Las Tunas	2,55	3,25
FCM Artemisa	2,43	3,14
UCM Granma	2,35	3,08
UCM Guantánamo	2,22	2,98
FCM Isla de la Juventud	2,17	2,91
NATIONAL AVERAGE	2,81	3,51

Although a positive and significant correlation between AI use and managerial competencies was confirmed across all contexts, the strength of this association was notably higher in CMUs (r = 0,64) than in FCMs (r = 0,48). This difference in the magnitude of the correlation coefficient is a crucial finding.

In discussing this, it can be inferred that mere access to or sporadic use of AI tools (which may occur in FCMs) is not sufficient. Effective integration that enhances managerial competencies seems to depend on a broader support ecosystem, likely present in CMUs, including formal curricular integration of AI, ongoing teacher training, and a learning environment that encourages the application of these tools to solve complex managerial problems. This underscores that the quality and depth of implementation are as important as the technology's availability.

The results on self-efficacy showed a consistent gap with objective performance. Students from institutions with high averages of use and competence, such as UCM Villa Clara (3,75 %) and Havana (3,62 %), reported greater confidence in their abilities. In contrast, students from FCM Isla de la Juventud (2,33 %) and UCM Guantánamo (2,50 %) showed self-efficacy significantly below the national average (3,18 %).

Table 7.3. Correlation between AI Use and Management Skills by Type of Institution

Management Competency	UCM (n=298) Correlation coefficient (r)	p-value	FCM (n=69) Correlation Coefficient (r)	p-value
Decision Making	0,55	<0,001	0,41	0,001
Care Planning	0,51	<0,001	0,38	0,002
Resource Management	0,44	<0,001	0,32	0,008
Team Leadership	0,38	<0,001	0,28	0,020
Global Management Competence	0,64	<0,001	0,48	<0,001

Discussing these findings corroborates the existence of the "acceptance paradox" at the institutional level. In contexts where implementation is weaker, there is not only less objective mastery, but also less subjective confidence.[16] This creates a vicious cycle in which a lack of confidence can further inhibit motivation to interact with these technologies.[17] This result reinforces the need for non-educational interventions to focus not only on providing tools, but also on building student confidence through successful and supported learning experiences.[18]

Table 7.4. Perception of Self-Efficacy by Institution

	"I feel capable of using AI" (Mean 1-5)
UCM Villa Clara	3,75
UCM Havana	3,62
UCM Cienfuegos	3,5
UCM Holguín	3,43
UCM Camagüey	3,38
UCM Santiago de Cuba	3,31
UCM Matanzas	3,24
UCM Sancti Spíritus	3,18
UCM Pinar del Río	3,1
UCM Ciego de Ávila	3,05
FCM Mayabeque	2,93
UCM Las Tunas	2,85
FCM Artemisa	2,64
UCM Granma	2,58
UCM Guantánamo	2,50
FCM Isla de la Juventud	2,33
NATIONAL AVERAGE	3,18

CONCLUSIONS

This study confirms a significant positive correlation between the use of Artificial Intelligence tools and the development of managerial skills among Cuban nursing students, thereby validating

the working hypothesis. However, this link is not uniform, but is nuanced by notable inter-institutional disparities, which reveal training gaps associated with contextual and resource factors.

A crucial finding is the identification of a self-efficacy gap: students recognize the value of AI but do not feel fully capable of applying it in their future management practice. These conclusions imply that integrating AI into the curriculum must be strategic, differentiated, and accompanied by a robust pedagogical component that builds competency confidence.

The limitations inherent in the cross-sectional design point to the need for future longitudinal research evaluating specific educational interventions. In short, AI is a valuable resource for nursing management training. Still, its potential will only be realized through contextualized implementations that prioritize equity and capacity building, rather than mere technological access.

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AUTHOR CONTRIBUTION

Conceptualization: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.

Formal analysis: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.

Research: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.

Methodology: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.

Writing – original draft: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.

Writing – review and editing: Juan Leonardo Pacios Dorado, Miguel Enrique Barroso Fontanals, Raiza Fernández Sosa.