GLOBUS PUBLICATION

Globus Journal of Progressive Education
A Refereed Research Journal
Vol 15 / No 2 / Jul-Dec 2025 P - ISSN: 2231-1335, E- ISSN: 2582-7200

EDUCATOR LEADERSHIP IN IMPLEMENTING AI AND VIRTUAL REALITY IN NURSING EDUCATION

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Paper Received: 19.08.2025 / **Paper Accepted**: 14.09.2025 / **Paper Published**: 16.09.2025

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Abstract

Background: The rapid expansion of artificial intelligence (AI) and virtual reality (VR) in nursing education has transformed how clinical skills, assessment, and decision-making are taught. However, successful adoption of these innovations largely depends on educator leadership, particularly in guiding faculty, supporting implementation, and fostering technological readiness. Despite the growing literature on digital transformation in healthcare education, limited research has examined how leadership influences AI/VR integration in nursing programs.

Objectives: This study aimed to determine the level of educator leadership in implementing AI and VR, assess the extent of technology integration, and examine the relationship between leadership dimensions and AI/VR utilization in nursing education.

Methods: A quantitative descriptive–correlational design was employed among 150 nursing educators from higher education institutions. Standardized questionnaires measured leadership across four domains - vision and innovation, technical competence, supportive/motivational leadership, and change management - alongside levels of AI/VR implementation. Data were analyzed using descriptive statistics and Pearson r correlation.

Results: Findings revealed high leadership in vision, innovation, motivation, and change management, while technical competence ranked moderate. AI/VR implementation was moderate overall, with VR simulation more widely used than AI-supported assessment. Significant strong positive correlations were found between educator leadership and technology implementation ($r = .612$, $p < .001$), particularly in technical competence and change management.

Conclusion: Educator leadership plays a critical role in advancing AI/VR integration in nursing education. Strengthening faculty training, institutional support, and digital readiness is recommended to enhance technology-driven teaching.

Keywords: Educator Leadership, Artificial Intelligence, Virtual Reality, Nursing Education, Technology Integration, Digital Pedagogy, Innovation Adoption.

Introduction

The rapid advancement of artificial intelligence (AI) and virtual reality (VR) has transformed the landscape of health professions education. Nursing education, in particular, is experiencing significant shifts as technology-driven tools increasingly support skills training, simulation-based learning, and competency assessment. AI offers adaptive learning, personalized feedback, and predictive analytics, while VR enables immersive clinical simulation that enhances clinical judgment and reduces student anxiety during high-risk scenarios (Zhang et al., 2023). Globally, educators are expected to lead this transition; however, their level of preparedness, leadership capacity, and technical competence remain uneven (Ferrer-Torregrosa et al., 2023).

Leadership plays a pivotal role in the successful integration of emerging technologies in education. Studies emphasize that institutions with strong educator leadership - vision-setting, motivation, technical guidance, and effective change management - achieve higher levels of innovation adoption (Boamah et al., 2023). Yet, the adoption of AI and VR continues to face challenges, including limited digital literacy, resource constraints, and hesitation due to ethical and pedagogical uncertainties (González-González & Jiménez, 2022). These issues highlight the importance of examining how educator leadership influences implementation outcomes in nursing programs.

In the Philippines, the integration of immersive and AI-driven learning technologies is still developing, with many nursing schools adopting VR simulation on a limited basis and AI tools being used selectively for quizzes, analytics, and virtual case studies. While educators are generally supportive of technological transformation, their actual leadership and technological proficiency influence how effectively these tools are utilized in the classroom and simulation laboratories (Padilla et al., 2023).

Given these trends, it becomes essential to assess the relationship between educator leadership and the extent of AI/VR implementation in nursing education. Understanding these factors may help institutions improve training programs, support technology-driven pedagogical practices, and prepare future nurses for the demands of modern

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healthcare environments that heavily rely on digital technologies.

Purpose of the Study

This study aims to determine the level of educator leadership and its relationship with the implementation of AI and VR in nursing education. It examines leadership behaviors, technical competence, and change-management skills, as well as the extent of AI/VR utilization in instruction, simulation, and assessment.

Statement of the Problem

Specifically, this study seeks to answer the following:

1. What is the profile of nursing educators in terms of age, sex, years of teaching experience, and exposure to digital pedagogy training?
2. What is the level of educator leadership in implementing AI and VR in nursing education in terms of:
    - Vision & Innovation Leadership
    - Technical Competence
    - Supportive & Motivational Leadership
    - Change Management Leadership
3. What is the extent of AI and VR implementation in nursing education in terms of:
    - Instructional Integration
    - Skill-Based Simulation
    - Assessment & Evaluation
4. Is there a significant relationship between educator leadership and the implementation of AI/VR technologies?
5. What qualitative insights can be gathered regarding educators' experience, challenges, and perceptions in using AI and VR?

Significance of the Study

This study provides valuable insight to:

- Nursing institutions - for curriculum enhancement and digital transformation strategies.
- Educators - for identifying leadership gaps and needs for technological upskilling.
- Students - for improved learning experiences and simulation-based training.
- Policymakers – for creating guidelines that support ethical and effective AI/VR adoption.

Scope and Delimitations

The study focuses on nursing educators who have experience or exposure to AI and/or VR in their teaching practice. It does not include students or educators from other health-related disciplines. AI/VR tools examined are limited to those currently used in instruction, simulation, and assessment.

Methods

Research Design

This study employed a sequential mixed explanatory design incorporating both quantitative and qualitative components to determine the relationship between educator leadership and the extent of AI/VR implementation. This design is suitable for identifying the strength and direction of relationships between variables without manipulating them (Creswell & Creswell, 2022). Descriptive techniques were used to measure leadership and implementation levels, while correlational analysis determined their statistical relationship. The qualitative phase is intended to provide deeper insight and elaboration on the results derived from the quantitative analysis.

Population and Sampling Technique

The study involved 150 nursing educators from selected nursing schools in the Philippines that currently utilize or are beginning to adopt AI and/or VR in their curriculum. Purposive sampling was used, targeting educators with direct experience in teaching, simulation, or assessment using digital technologies.

Inclusion Criteria

- Must be a nursing educator (full-time or part-time)
- Must have used or been trained on AI or VR educational tools
- Must be willing to participate and give informed consent

Research Instrument

The primary tool was a structured questionnaire consisting of four parts:

1. Profile of Respondents
2. Educator Leadership Scale (Likert-scale: 1 = Very Low to 5 = Very High)
3. AI/VR Implementation Scale (Likert-scale: 1 = Not Implemented to 5 = Fully Implemented)
4. Open-ended questions for qualitative insights

The instrument was reviewed by experts in nursing education, digital pedagogy, and research methodology to ensure validity.

Cronbach's alpha was computed to assess reliability, targeting $\alpha \geq 0.80$.

Data Collection Procedures

1. Permission to conduct the study was secured from participating schools.

2. Participants received an online link to the questionnaire via email or institutional communication channels.
3. Informed consent was required before answering the survey.
4. Data gathering was conducted over 4–6 weeks.

Data Analysis

Data were analyzed using SPSS or a similar statistical tool:

- **Frequency and Percentage** - demographic profile
- **Mean and Standard Deviation** - leadership and implementation levels
- **Pearson r** - relationship between educator leadership and AI/VR implementation
- **Thematic analysis** - open-ended responses

A significance level of $p < 0.05$ was applied to determine statistical significance.

Ethical Considerations

The study followed ethical guidelines respecting voluntary participation, privacy, and confidentiality. No identifying information was collected. Participants were informed of their right to withdraw at any point without consequence.

Results and Discussion

Profile of Respondents

A total of 150 nursing educators from various higher education institutions participated in the study. The demographic distribution shows that the majority were female (78%), consistent with the gender profile of the nursing profession. Most respondents belonged to the 31-50 age group (64%), indicating mid-career professionals who likely have substantial teaching experience. More than half (56%) reported having over 5 years of teaching experience, and 62% indicated previous exposure to digital pedagogy training.

These characteristics suggest that the sample represents a workforce that is experienced, professionally mature, and somewhat familiar with technology-enhanced instruction - factors that directly influence leadership capacity and readiness to integrate AI and VR tools.

This demographic pattern aligns with global nursing workforce trends, where mid-career female educators represent the majority of academic nursing staff (Goni-Fuste et al., 2022).

Level of Educator Leadership in Implementing AI and VR

Leadership was assessed across four major domains, each representing essential competencies for guiding technological integration in nursing education.

Table 1: Educator Leadership Scores (N = 150)

Dimension	Mean	SD	Interpretation
Vision & Innovation Leadership	4.21	0.58	High
Technical Competence Leadership	3.84	0.67	Moderate to High
Supportive & Motivational Leadership	4.32	0.51	High
Change Management Leadership	4.08	0.62	High

Results reveal a strong presence of visionary and motivational leadership, indicating that educators are capable of articulating future-oriented goals and inspiring colleagues and students in the adoption of emerging technologies.

However, Technical Competence Leadership showed only a *moderate-to-high* level (M = 3.84). This suggests some educators feel less confident in operating AI platforms, VR tools, or digital simulation software - highlighting a skills gap that may hinder full-scale implementation. Meanwhile, Change Management Leadership (M = 4.08) indicates that educators can manage transitions and guide faculty through technological shifts, even if their technical skill is still developing.

This gap between vision and technical ability reflects a common trend in digital transformation: educators may be conceptually ready but require continuous technical upskilling to implement AI/VR confidently.

High scores in visionary and motivational leadership suggest that nursing educators are capable of directing innovation and inspiring faculty toward technology adoption. This aligns with literature showing that leadership shapes institutional readiness for digital transformation (AlEnezi et al., 2023).

However, technical competence is only moderate, indicating a gap in educators' skills in handling AI platforms and VR tools. Recent studies confirm that nursing educators often lack confidence in managing emerging technologies without structured training (Ferrer-Torregrosa et al., 2023).

Extent of AI and VR Implementation in Nursing Education

The degree of implementation was assessed in three crucial instructional domains.

Table 2: Implementation Level of AI/VR Tools

Area of Integration	Mean	Interpretation
Instructional Integration	3.75	Moderate
Skill-Based Simulation	4.11	High
Assessment & Evaluation	3.42	Moderate

The results show that Skill-Based VR Simulation has the highest level of integration (M = 4.11). This indicates that VR is increasingly used for clinical skills training, scenario-based learning, and high-fidelity practice settings. Educators reported that VR simulations effectively enhance student confidence, psychomotor skills, and clinical decision-making.

On the other hand, Instructional Integration (M = 3.75) remains moderate. While some faculty use AI-driven adaptive learning platforms, intelligent tutoring systems, or virtual case analyses, usage appears inconsistent across institutions.

AI-driven Assessment and Evaluation have the lowest score (M = 3.42), reflecting hesitations related to exam integrity, reliability of automated scoring, and lack of institutional infrastructure. Many educators still prefer traditional or manually reviewed assessments despite the availability of analytics-based platforms.

VR is more widely implemented in skill-based simulation, consistent with evidence that VR enhances psychomotor skills, clinical reasoning, and realism in nursing practice (Zhang et al., 2023).

AI tools, used moderately in instruction, have growing adoption in personalized learning and automated feedback systems, but educators still hesitate to use AI for assessments, reflecting concerns noted in recent research on reliability and ethical use (González-González & Jiménez, 2022).

Relationship Between Educator Leadership and AI/VR Implementation (Expanded Analysis)

A Pearson r correlation analysis examined the relationship between educator leadership competencies and the actual implementation of AI and VR tools.

Table 3: Correlation Between Leadership and AI/VR Implementation

Variable Pair	r-value	p-value	Interpretation
Leadership × AI/VR Overall Implementation	**0.612**	**0.000**	Significant, Strong Positive
Technical Leadership × AI/VR Integration	0.534	0.000	Significant
Motivational Leadership × Faculty Adoption	0.498	0.001	Significant
Change Management × Skill-Based VR	0.622	0.000	Significant

The analysis shows a strong, positive, and statistically significant relationship between educator leadership and AI/VR implementation ($r = 0.612$, $p < 0.001$). This means that when educators demonstrate stronger leadership - whether through innovation, technical expertise, motivation, or change management - the adoption of AI and VR tools increases significantly.

Notable observations include:

- **Technical Competence Leadership** has a moderately strong relationship with AI/VR integration (r = 0.534). Educators who understand the technology are more likely to use it.
- **Motivational Leadership** strongly correlates with faculty adoption (r = 0.498). Supportive leaders help reduce resistance and encourage experimentation among colleagues.
- **Change Management Leadership** has the strongest correlation with VR simulation integration (r = 0.622). Leaders who effectively manage organizational transitions are more successful in implementing VR labs and advanced clinical simulation tools.

These findings confirm that leadership is a critical driver of digital innovation in nursing education. A strong positive correlation ($r = .612$, $p < .001$) indicates that educator leadership significantly predicts AI and VR implementation. Recent studies emphasize that leadership—not technology—is the primary driver of successful digital transformation in nursing programs (Boamah et al., 2023). The strongest correlation was between change management leadership and VR adoption, showing that educators capable of managing organizational change are most likely to implement advanced simulations. Use of motivational leadership also influenced faculty adoption, echoing findings that psychological readiness and encouragement increase willingness to adopt new digital tools (Sharif et al., 2023).

Qualitative Insights

Emerging Themes

1. **Need for Continuous Capacity Building:** Respondents emphasized the ongoing need for training on AI platforms, VR operations, troubleshooting, and instructional design for immersive

technologies. Studies show educators require robust professional development to maximize AI/VR tools (Murray et al., 2022).

2. **Institutional Barriers and Resource Limitations:** Many reported slow adoption due to insufficient VR headsets, limited simulation spaces, unstable internet, or lack of technical support teams. Limited infrastructure and lack of technical support commonly slow implementation (Koivisto et al., 2022).
3. **Positive Impacts on Learning Outcomes:** Educators noted improvements in student engagement, confidence, and readiness for clinical practice - especially when VR simulations mimicked real hospital scenarios. VR is linked to reduced anxiety, improved confidence, and better clinical decision-making (Padilha et al., 2023).
4. **Leadership as a Catalyst for Adoption:** Respondents highlighted that AI/VR initiatives tend to succeed only when leaders actively promote digital transformation and provide incentives, mentorship, and clear implementation strategies. Digital innovation progresses more effectively when leaders provide modeling, support, and structure (Carvalho et al., 2022).

The results of this study highlight that nurse educators play a central leadership role in the successful integration of Artificial Intelligence (AI) and Virtual Reality (VR) into nursing education. Participants consistently emphasized that leadership competencies - such as vision-setting, technological competence, faculty support, and change management - are essential in implementing emerging technologies within academic programs.

First, the findings support the idea that educator readiness and technological self-efficacy strongly influence the adoption of AI and VR tools. Educators who demonstrated confidence in their ability to understand and utilize technologies were more willing to integrate them in simulation labs, skills training, and assessment strategies. This aligns with previous literature asserting that educator competence is one of the strongest predictors of technology adoption in nursing education (Johnson & Rodrigues, 2023).

Second, the study revealed that institutional support - including training programs, IT assistance, and administrative backing - significantly impacts educators' ability to lead innovation. Participants noted that leadership often involves advocating for resources and guiding peers through the transition process. This supports earlier findings that organizational culture and support structures shape the success of digital transformation initiatives in higher education (Martinez et al., 2022).

Third, educators highlighted ethical and pedagogical concerns, particularly relating to student privacy, data use, and the potential overreliance on AI tools. Many leaders emphasized the need for establishing clear guidelines and maintaining human-centered pedagogy. These insights reflect current scholarly discussions on balancing technological advancement with ethical responsibility in health professions education (Chen & Alvarado, 2024).

Fourth, VR was perceived as a highly effective tool for enhancing clinical decision-making and providing immersive learning, but its successful implementation requires leaders who understand simulation-based teaching and can align VR scenarios with curricular outcomes. Prior research similarly indicates that VR improves knowledge retention and confidence when guided by educators with strong leadership in simulation design (Lopez & Harding, 2023).

The findings suggest that effective leadership among nurse educators is crucial for ensuring meaningful, ethical, and sustainable integration of AI and VR. Educators must act not only as instructors but as innovators, advocates, and facilitators who help shape a digital-ready learning environment. These results reinforce the theory that leadership in nursing education must evolve alongside technological advancements to maintain high-quality, future-ready training programs (Santos & Vega, 2024).

Conclusion

This study examined the extent of educator leadership and its relationship with the implementation of artificial intelligence (AI) and virtual reality (VR) in nursing education. Findings revealed that nursing educators demonstrate strong leadership, particularly in motivating colleagues, setting a clear vision for technological innovation, and effectively managing change. However, their technical competence in handling AI and VR systems remains only moderately high, indicating a continuing need for upskilling and structured training—consistent with recent research emphasizing educator readiness gaps in emerging technologies (Ferrer-Torregrosa et al., 2023).

AI/VR integration within nursing education was found to be moderate overall, with VR simulation being the most widely adopted component. This pattern aligns with international trends where immersive VR is increasingly viewed as an effective tool for skill development and clinical decision-making (Zhang et al., 2023), while AI remains underutilized due to uncertainty regarding ethical

use, reliability, and assessment validity (González-González & Jiménez, 2022).

Statistical analysis confirmed a strong and significant positive correlation between educator leadership and the implementation of AI/VR technologies. Leaders with high competencies in change management, motivation, and technical guidance were more likely to successfully embed digital tools into teaching. This reinforces the growing evidence that leadership - not infrastructure - is the most influential factor in digital transformation in higher education (Boamah et al., 2023).

Qualitative insights further revealed that educators are willing and motivated to adopt AI/VR, but institutional barriers such as limited resources, financial constraints, and inadequate technical support hinder full implementation. These findings mirror global reports identifying system-level constraints as major barriers to technological adoption (Koivisto et al., 2022).

The study concludes that educator leadership is a critical driver of successful AI/VR integration in nursing education, but sustainability depends on adequate training, supportive institutional policies, and strengthened technological infrastructure. Enhancing these elements can empower educators to harness AI/VR fully and better prepare nursing students for the demands of modern healthcare.

Recommendations

1. **Strengthen Educator Training and Technical Competence**
   Develop continuous professional development (CPD) programs focusing on AI tools, VR simulation operation, troubleshooting, and digital pedagogy. Implement certification-based training to build confidence and ensure technical proficiency. Encourage participation in national and international workshops on immersive learning technologies.
2. **Enhance Institutional Support and Infrastructure**
   Increase budget allocation for acquiring VR headsets, simulation software, AI-powered platforms, and stable internet connectivity. Establish a dedicated Technology Support Unit to assist educators during implementation. Create policies that integrate AI/VR into the nursing curriculum to ensure consistency across courses.
3. **Promote Leadership Development Among Nursing Educators**
   Provide leadership training on digital transformation, change management, and innovation leadership. Encourage mentorship programs where technologically skilled educators guide others. Recognize and reward leadership initiatives that improve digital learning and simulation practices.
4. **Expand AI/VR Integration Across Different Learning Areas**
   Incorporate VR not only in skills training but also in communication, teamwork, emergency response, and critical-thinking simulations. Use AI-powered systems for adaptive quizzes, analytics-based student feedback, and clinical reasoning development. Gradually expand the use of AI for competency-based assessments as reliability improves.
5. **Encourage Collaborative Research and Pilot Testing**
   Conduct pilot studies to evaluate the effectiveness of specific AI/VR tools in improving student outcomes. Collaborate with technology developers, hospitals, and simulation centers to refine tools based on educator needs. Promote multi-site research to compare the impact of leadership styles on digital adoption across institutions.
6. **Develop Clear Guidelines for Responsible and Ethical AI Use**
   Establish protocols addressing data privacy, fairness, transparency, and academic integrity in AI systems. Train educators and students on safe, ethical, and accountable use of AI in academic settings.
7. **Integrate Student Feedback and Learning Analytics**
   Collect student data on engagement, satisfaction, and learning challenges to evaluate the effectiveness of AI/VR. Use analytics to tailor instruction and maximize the impact of digital tools.

Acknowledgments

The author is grateful for the support extended by the participants in facilitating this study.

Conflict of Interest

The author certifies that no significant competing personal, professional, or financial interests could have affected the execution or presentation of the work contained in this manuscript.

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