

Effectiveness of Structured Teaching Programme on Knowledge Regarding Robotics in Nursing and in Healthcare Delivery and its Functions Among Nursing Students of Sharda University

Simran Negi¹; Shobha Yadav²; Chanchal Lata³; Poonam Thakur^{4*}

¹BSc Nursing Student, Sharda School of Nursing Science and Research, Sharda University.

²BSc Nursing Student, Sharda School of Nursing Science and Research, Sharda University.

³Assistant Professor, Department of Community Health Nursing, Sharda School of Nursing Science and Research, Sharda University.

⁴Associate Professor, Department of Medical Surgical Nursing, Sharda School of Nursing Science and Research

Corresponding: Poonam Thakur^{4*}

Publication Date: 2026/10/06

Abstract:

➤ *Background and Aim:*

Robotics is increasingly being used in healthcare to support patient care, monitoring, rehabilitation, medication-related activities, surgical procedures, and other healthcare services. However, nursing students may have limited knowledge and exposure to robotics because it is not given adequate emphasis in the nursing curriculum. Therefore, structured teaching programmes may help students develop a better understanding of robotics and its applications in nursing and healthcare delivery.

➤ *Methods:*

A quantitative research approach with a pre-experimental one-group pre-test and post-test design was adopted to assess the effectiveness of a Structured Teaching Programme (STP) on knowledge regarding robotics in nursing and healthcare delivery among B.Sc. Nursing students of Sharda University, Greater Noida. A total of 100 nursing students were selected using convenience sampling. Data were collected using a self-structured knowledge questionnaire. A Structured Teaching Programme covering the concepts, types, applications, advantages, limitations, and functions of robotics in nursing and healthcare delivery was provided. Pre-test and post-test knowledge scores were compared using descriptive and inferential statistics.

➤ *Results:*

In the pre-test, 89% of students had average knowledge, 10% had poor knowledge, and only 1% had good knowledge. In the post-test, 89% of students achieved good knowledge and 11% had average knowledge, with no students remaining in the poor knowledge category. The mean knowledge score increased from 13.6 ± 3.2 in the pre-test to 24.4 ± 2.9 in the post-test, with a mean difference of 10.8. The paired *t*-test value was 27.10 with $p = .001$, showing a statistically significant improvement in knowledge. A significant association was found between post-test knowledge and semester of study ($\chi^2 = 51.6, p = .001$), while other selected demographic variables showed no significant association.

➤ *Conclusion:*

The findings indicate that the Structured Teaching Programme was effective in improving B.Sc. Nursing students' knowledge regarding robotics in nursing and healthcare delivery. Structured education on emerging healthcare technologies may therefore be useful in preparing nursing students for technology-supported clinical practice.

Keywords: Robotics, Robotics in Nursing, Robotics in Healthcare Delivery.

How to Cite: Simran Negi; Shobha Yadav; Chanchal Lata; Poonam Thakur (2026) Effectiveness of Structured Teaching Programme on Knowledge Regarding Robotics in Nursing and in Healthcare Delivery and its Functions Among Nursing Students of Sharda University. *International Journal of Innovative Science and Research Technology*, 11(9), 3003-3011. <https://doi.org/10.38124/ijisrt/26sep1358>

I. INTRODUCTION

The integration of technology in healthcare has led to a new era of patient management and clinical practice. Among the most transformative of these technologies is robotics, which is rapidly reshaping the landscape of healthcare delivery worldwide. Enhancing efficiency, reducing costs, and improving patient outcomes are among the goals driving the growing interest in robotics and automation in healthcare. At the forefront of this technology transformation is the nursing profession, which makes up the majority of the healthcare workforce. Despite the increasing deployment of robotic systems in clinical settings, nursing students often graduate with insufficient understanding of robotic applications. Despite the widespread usage of robots in healthcare, nursing education lags behind in providing robotics-related curriculum and experiences. Nursing courses must include specific educational initiatives to close this knowledge gap. (Babalola GT, Gaston JM, Trombetta J, Tulk Jesso S. 2024)

Robotics is one of the most significant technological innovations influencing modern healthcare systems. Robots present a remarkable opportunity to enhance healthcare delivery, allowing nurses to focus on high-value caregiving rather than routine tasks. In the current era of healthcare transformation, nurses must be equipped with adequate knowledge of emerging technologies to provide safe and effective care. The State of the World's Nursing 2020 report indicates that the global workforce will experience a deficit of up to 4.6 million nurses by 2030, making technological solutions like robotics increasingly vital. Nursing students, as the future workforce, must be prepared to work alongside robotic systems in clinical environments. The robotics sector is developing quickly, offering a variety of technologies that have the potential to transform healthcare delivery and enhance nurse practice. However, formal education on robotics remains largely absent from most nursing curricula globally. Structured Teaching Programmes serve as a systematic means of bridging this educational gap. They deliver standardized, measurable, and reproducible educational content to large groups of learners. (Kangasniemi M, Karki S, Colley N, Voutilainen A. 2019)

The 21st century has witnessed unprecedented technological advancements transforming nearly every aspect of healthcare delivery. Robotics in nursing represents one of the most promising frontiers in this transformation. Nursing functions are being drastically changed by robotic-assisted technology, which is increasingly assisting nurses with medicine delivery, patient monitoring, and even surgical assistance. Nursing students must therefore develop an informed understanding of these systems before entering clinical practice. Numerous robotic applications are being proposed to help or replace nurses in specific activities, which may be explained by nursing shortages, burnout, and

excessive overload. Educational programmes specifically designed to enhance robotic literacy among students are the need of the hour. In order to meet the demands brought on by technological advancements like robotics, authors have called for the creation of a new infrastructure, especially in education. (Pepito JA, Uchida T, Ozaki A, Tanimoto T.)

Technological innovation in healthcare is progressing at an unprecedented pace, with robotics playing an increasingly central role in clinical practice. The robotics sector is developing quickly, offering a variety of solutions that have the potential to transform health care delivery and enhance nursing practice. Within nursing, robotic systems are being used for patient lifting, medication delivery, surgical assistance, and telepresence. Nursing students must acquire comprehensive knowledge of these applications to ensure patient safety and quality care. With robots supporting nurses, promoting remote learning opportunities, and facilitating skill development, the simulation centre might be the most suitable and useful location for robot testing and application in nursing education. However, most nursing institutions still lack standardized training programs in this area. This gap may be addressed through a Structured Teaching Programme, which offers methodical, goal-oriented education. The goal of this study is to assess how such a program affects nursing students' robotics knowledge. (Zrinyi M, Pakai A, Lampek K 2023)

Modern healthcare systems are increasingly dependent on robotic technologies to address critical challenges such as nurse shortages, high patient loads, and the need for precision in care delivery. Despite efforts by significant international nursing organizations, the worldwide nursing crisis which was recognized in 2002 has continued, and the COVID-19 pandemic and an aging population have made the shortage of nurses even worse. Robotics offers a transformative solution to these systemic challenges. However, nurses and nursing students need adequate knowledge to optimally utilize robotic systems. Challenges in incorporating robotics into nursing education include simulation fidelity and technological problems, while benefits include assisting nurses and fostering remote learning opportunities. (Mudd SS, Mbemba G, Gagnon MP)

The global healthcare environment is being fundamentally redefined by advances in robotics and automation. Over the past few decades, there has been a growing interest in robotics in healthcare due to the need to improve patient outcomes, increase efficiency, and lower costs. For nurses who form the backbone of health service delivery understanding these technologies has become an essential professional competency. The surge in the older population amplifies the reliance on nursing services and exacerbates the worldwide shortage of nurses, making robotic solutions increasingly relevant. In this evolving landscape, nursing education must be realigned to prepare students for

technology-integrated clinical practice. Educational approaches that integrate systematic information acquisition with directed, experiential, and introspective tasks are essential for fostering critical evaluation and applying theoretical comprehension in therapeutic settings. (El-Gazar HE, Abdelhafez S, Ali AM 2024)

Nursing is at a critical juncture where traditional care practices must be integrated with advanced technologies such as robotics to meet the demands of modern healthcare. Collaborative robots are intended to free up nurses to concentrate on high-value nursing instead of repetitive or physically taxing duties. This evolving role of nurses requires a comprehensive understanding of robotics, including its types, functions, and implications for patient care. Robotic integration raises a number of issues, such as difficulties integrating clinical workflow, technical constraints, and the possibility that excessive automation could diminish human connection. Equipping nursing students with accurate and balanced knowledge about robotics can enable them to navigate these challenges more effectively. Studies highlight a persistent gap in formal training programmes, with many students unaware of the indications and applications of newer surgical and robotic techniques. Structured Teaching Programmes have proven to be an effective strategy for systematically delivering knowledge to student nurses. (Linge TK)

The emergence of robotics in clinical nursing is reshaping job responsibilities, skill requirements, and the nature of patient-nurse interactions. An educational video-based intervention found that increased perception and valuable insights from nurses and nursing students provide a strong foundation for identifying opportunities for incorporating robotic technology in healthcare settings. This demonstrates that structured educational inputs can significantly alter nursing students' awareness and attitudes toward robotics. Compared to conventional industrial robots, collaborative robots offer advantages such as increased productivity, lower labour costs, flexibility, better quality, and an improved workplace. Understanding these benefits equips nursing students to become advocates for safe and effective robotic integration. The COVID-19 pandemic, population ageing, and ongoing attrition among nursing professionals have further worsened the global nursing shortage and increased the burden on the remaining workforce. (González-García A, Ramírez-García C, Martínez-Riera JR)

Technology has always been a driving force in the evolution of nursing practice, from the stethoscope to sophisticated robotic systems. Rapid technological advancement is drastically changing roles in a number of professions, including healthcare. Innovative tools like robotic systems are being used in nursing education to get around obstacles such as restricted clinical access, distance, and participation. Nursing students, as future healthcare professionals, need to be technologically literate, particularly in the area of robotics. An umbrella review aimed at synthesizing evidence on the utilisation of robots in nursing practice found that broader implementation of robotics could

address challenges such as the ageing global population and nurse shortages worldwide. Knowledge regarding the types, functions, and potential of robotic systems is foundational to safe robotic-integrated nursing care. Large cohorts of nursing students are more likely to have consistent learning gains from programs with well-defined objectives, uniform materials, and fidelity checks. (İnam Ö, Okay S 2025)

The future of nursing practice is inextricably linked to the advancement of robotic technologies in healthcare settings. The robotics sector is developing quickly, offering a variety of options that could transform healthcare delivery and enhance nurse practice. Nursing students, as the professionals of tomorrow, must be equipped with current and comprehensive knowledge about robotics and its applications in patient care. The broader implementation of robotics in nursing practice has been proposed as a solution to the range of challenges facing nursing care globally, including the surge in older populations and the exacerbating shortage of nurses worldwide. Yet, educational systems have been slow to incorporate structured, standardized robotics content into nursing programmes. Researchers in the field have highly recommended that nurses be included in the management of robotic integration through participation in planning and design, as well as the development of robotic-related competences. Achieving this requires purposeful educational initiatives at the student level. (WHO 2020)

➤ *Hypotheses*

- H01: There will be no significant difference between pre-test and post-test knowledge scores.
- H02: There will be no significant association between post-test knowledge scores and selected demographic variables

II. METHODS AND MATERIALS

➤ *Research Design and Setting*

A pre-experimental one-group pre-test and post-test design was used in this study. This design enabled the researcher to compare the participants' pre-test and post-test knowledge scores following the Structured Teaching Programme. The present study was conducted in Sharda School of Nursing Science & Research, Sharda University, Greater Noida, Uttar Pradesh, affiliated to the state university of health sciences and recognized by the Indian Nursing Council.

➤ *Population and Sample*

- Target population: The target population comprises all B.Sc. Nursing students studying in Sharda School of Nursing Science and Research, Sharda University.
- Accessible population: The accessible population includes students who meet the inclusion criteria and are available during the period of data collection.
- The sample for the study consists of B.Sc. Nursing students aged between 17 and 25 years who are studying at the selected setting.

➤ *Inclusion Criteria:*

- The inclusion criteria for the study were nursing students aged between 17 and 25 years.
- Nursing students who are willing to take part in the study and are enrolled in B.Sc. nursing program.
- Students who are able to communicate effectively.
- Students who were present during the data collection period and who can understand English or Hindi.

➤ *Exclusion Criteria:*

- Students of other nursing programmes (Post-Basic B.Sc. Nursing, and M.Sc. Nursing).
- Students who are on long leave.
- Students who are repeating the year following a break in study, or are unavailable during the data collection period.

➤ *Ethical Considerations*

- Ethical clearance was obtained from the Institutional Ethics Committee of Sharda University (Ref. No. SU/SMS&R/76-A/2026/128). Written informed consent was obtained from each participant after explaining the study purpose. Anonymity and confidentiality were strictly maintained throughout the study.

➤ *Data Collection Tools*

Three instruments were used:

- Section I: Description of the demographic variables of the participants.
- Section II:
- ✓ Frequency and percentage distribution of participants according to their level of knowledge regarding robotics in nursing and healthcare delivery in the pre-test.
- ✓ Frequency and percentage distribution of participants according to their level of knowledge regarding robotics in nursing and healthcare delivery in the post-test.
- Section III: Comparison of knowledge scores of nursing students regarding robotics in pre-test and post-test.
- Section IV: Association between post-test score with demographic variable in nursing students in post-test.

The prepared tool, together with the objectives, operational definitions, and criteria checklist, was submitted

to a panel of five experts for evaluation of its relevance, correctness, appropriateness, and clarity. The suggestions provided by the experts were considered and the tool was modified accordingly.

➤ *Educational Package*

The educational package comprised a structured lesson plan delivered via lecture, PowerPoint presentation, and a printed leaflet. Content covered: introduction and definition of robotics in nursing and in healthcare delivery, importance, types, uses, advantages and disadvantages of robotics in nursing and in healthcare delivery.

➤ *Procedure*

A pilot study is a brief exploratory investigation carried out before the major study to determine the viability of the research strategy and the appropriateness of the data gathering method. Sharda School of Nursing Science and Research was served as the site of the pilot research for this investigation. Following the completion of the pilot study, the major investigation was conducted with formal authorization from the relevant authorities and Institutional Ethics Committee ethical approval. One hundred undergraduate nursing students were chosen for the study based on their compliance with the inclusion criteria.

The pilot study assessed the clarity and comprehensibility of the items, the time required for completion of the questionnaire (approximately 25–30 minutes), the adequacy of the data collection procedure, and the reliability of the instruments. It also provided an opportunity to conduct a trial run of the proposed data analysis plan.

➤ *Data Analysis*

The collected data were checked, organized, coded, entered into a master sheet, and analyzed using the Statistical Package for the Social Sciences (SPSS). The statistical analysis was carried out according to the objectives and hypothesis of the study. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to describe the demographic characteristics of the participants and their knowledge scores. The Chi-square test was used to find out the association between the knowledge scores and selected demographic variables. Inferential statistics were used to determine the effectiveness of the structured teaching programme by comparing the pre-test and post-test knowledge scores. The results were interpreted according to the level of significance used in the study.

III. RESULTS

Table 1 Frequency (n) and Percentage (%) of the Participants' Distribution of the Participants According to Demographic Data. (N=100)

Variable	Category	Frequency (n)	Percentage (%)
Age	17-19	36	36.0
	20-22	53	53.0
	23-25	11	11.0
	Above 25	0	0
Gender	Male	23	23.0

	Female	77	77.0
Semester of the study	2nd semester BSc nursing	17	17.0
	4th semester BSc nursing	70	70.0
	6th semester BSc nursing	13	13.0
Previous knowledge about robotics in nursing	Yes	41	41.0
	No	59	59.0
Sources of previous knowledge	Classroom teaching	28	28.0
	Internet	34	34.0
	Workshop/seminar	5	5.0
	Social media	8	8.0
	Others	25	25.0
Have you ever attended any training or workshop on robotics in healthcare	Yes	20	20.0
	No	80	80.0
Exposure to clinical settings where robotics is used	Yes	18	18.0
	No	82	82.0
Area of residence	Urban	90	90.0
	Rural	10	10.0
Interested in learning new technologies in nursing	Highly interested	56	56.0
	Moderately interested	40	40.0
	Not interested	4	4.0

The majority of participants, 53 (53.0%), were in the age of 20-22 years followed by 36 (36.0%) participants aged 17–19 years and 11 (11.0%) aged 23–25 years. None were above 25 years of age. A significant majority of participants were female 77 (77.0%), while males represented 23 (23%). Most participants were in 4th semester of B.Sc. Nursing 70 (70.0%), with fewer in 2nd semester B.Sc. Nursing 17 (17.0%), followed by 13 (13.0%) from the 6th semester. A slight majority of 59 (59.0%) participants reported that they had no previous knowledge, whereas 41 (41.0%) had previous knowledge. Among the sources of previous knowledge, the Internet was the most common source (34.0%), followed by classroom teaching (28.0%), other

sources (25.0%), social media (8.0%), and workshops/seminars (5.0%). The majority of participants, 80 (80.0%) had never attended any training or workshop on robotics in healthcare, while only 20 (20.0%) had attended training or workshop. A substantial 82 (82.0%) participants had no exposure to clinical settings where robotics was used, whereas 18 (18.0%) had such exposure. The majority of participants 90 (90.0%) were from urban areas, while 10 (10.0%) were from rural areas. Concerning interest in learning new technologies in nursing, 56 (56.0%) participants were highly interested, 40 (40.0%) were moderately interested, and only 4 (4.0%) were not interested.

Table 2 Frequency and Percentage Distribution of Participants Based on Level of Knowledge Regarding Robotics in Nursing and in Healthcare Delivery in Pre-Test. (N=100)

Knowledge level	Category scores	Frequency	Percentage
Poor	1-10	10	10%
Average	11-20	89	89%
Good	21-29	1	1%
Total		100	100

The data presented in Table 2, shows the frequency and percentage distribution of participants based on their pre-test knowledge regarding robotics in nursing and healthcare delivery. It showed that 10% of the participants had poor

knowledge, 89% had average knowledge, and 1% had good knowledge regarding robotics in nursing and healthcare delivery.

Table 3 Frequency and Percentage Distribution of Participants Based on Level of Knowledge Regarding Robotics in Nursing and in Healthcare Delivery in Post-Test. (N=100)

Knowledge level	Category scores	Frequency	Percentage
Poor	1-10	0	0%
Average	11-20	11	11%
Good	21-29	89	89%
Total		100	100

The data presented in table 3 demonstrate the frequency and percentage distribution of participants according to their post-test knowledge of robotics in nursing and healthcare delivery. The table shows that 11% of the participants had an

average level of knowledge, 89% had a good level of knowledge, and none of the participants had poor knowledge in the post-test.

Table 4 Comparison of Knowledge Scores of Nursing Students Regarding Knowledge about Robotics in Nursing and in Healthcare Delivery in Pre-Test and Post-Test. (N=100)

Knowledge	Mean	Standard Deviation	Mean Difference	Paired t-test	P value
Pre-test	13.6	3.2	10.8	27.10	.001
Post-test	24.4	2.9			

Table 4 shows a statistically significant difference between the pre-test and post-test mean knowledge scores of the nursing students regarding robotics in nursing and in healthcare delivery. The post-test mean knowledge score was (24.4) higher than the pre-test mean knowledge score.

The pre-test mean knowledge score was (13.6). The null hypothesis (H01) was rejected at the selected level of significance.

Table 5 Association Between Post-Test Knowledge Scores and Selected Demographic Variables of B.Sc. Nursing Students. (N=100)

S.No	Demographic variable	Post-test scores			Chi-square	p-value
		Poor	Average	Good		
1.	Age					
	17-19	-	3	33	26.2	.34
	20-22	-	7	46		
	23-25	-	1	10		
	Above 25	-	-	-		
2.	Gender					
	Male	-	4	19	8.09	.77
	Female	-	7	70		
3.	Semester					
	2nd semester BSc nursing	-	-	17	51.6	.001
	4th semester BSc nursing	-	8	62		
	6th semester BSc nursing	-	3	10		
4.	Previous knowledge about robotics in nursing					
	Yes	-	5	36	13.1	.35
	No	-	6	53		
5.	Sources of previous knowledge					
	Classroom teaching	-	5	23	43.6	.65
	Internet	-	1	33		
	Workshop/seminar	-	-	5		
	Social media	-	2	6		
	Others	-	3	22		
6.	Have you ever attended any training or workshop on robotics in healthcare					
	Yes	-	2	18	10.6	.56
	No	-	9	71		
7.	Exposure to clinical settings where robotics is used					
	Yes	-	3	15	5.1	.95
	No	-	8	74		
8.	Area of residence					
	Urban	-	11	89	6.5	.8

	Rural	-	-	10		
9.	Interested in learning new technologies in nursing					
	Highly interested	-	5	51	32.6	.11
	Moderately interested	-	5	35		
	Not interested	-	1	3		

Table 5 represent that there is a statistically significant association was found between post-test knowledge scores and semester of study ($p < 0.05$), whereas no statistically significant association was found between post-test knowledge scores and the other selected demographic variables.

IV. DISCUSSION

According to the study's aims, the results are compiled under the following headings.

- Most participants (53%) were aged 20–22 years, followed by 36% aged 17–19 years and 11% aged 23–25 years. None were above 25 years.
- The majority of participants (77%) were female, while 23% were male.
- Most participants (70%) were studying in the 4th semester of B.Sc. Nursing, followed by 17% in the 2nd semester and 13% in the 6th semester.
- About 59% of participants had no previous knowledge of robotics in nursing, while 41% had some prior knowledge.
- The internet (34%) was the main source of previous knowledge, followed by classroom teaching (28%), other sources (25%), social media (8%), and workshops/seminars (5%).
- Most participants (80%) had never attended training or workshops on robotics in healthcare.
- A large majority (82%) had no clinical exposure to settings where robotics was used.
- Most participants (90%) belonged to urban areas, while 10% were from rural areas.
- More than half (56%) were highly interested in learning new technologies in nursing, 40% were moderately interested, and only 4% were not interested.
- In the pre-test, most participants (89%) had an average level of knowledge, 10% had poor knowledge, and only 1% had good knowledge about robotics in nursing and healthcare delivery.
- In the post-test, 89% of participants achieved a good level of knowledge, while 11% had an average level. None remained in the poor category.
- Overall, the results showed a clear improvement in knowledge after the structured teaching programme.
- Between the pre-test and the post-test, the mean knowledge score rose from 13.6 (SD = 3.2) to 24.4 (SD = 2.9).
- Following the planned instruction program, student's knowledge clearly improved, as evidenced by the mean difference of 10.8.
- The paired t-test showed a statistically significant difference between the pre-test and post-test knowledge scores ($t = 27.10$, $p = .001$).

- As the p-value was below 0.05, the null hypothesis (H01) was rejected. The findings demonstrated that the Structured Teaching Programme was successful in raising the B.Sc. Nursing students' understanding of robotics in nursing and healthcare delivery.
- The student's post-test knowledge scores and their semester of study were also found to be statistically significantly correlated ($\chi^2 = 51.6$, $p = .001$).
- No significant association was found between post-test knowledge scores and age, gender, previous knowledge, source of information, previous training or workshops, clinical exposure to robotics, area of residence, or interest in learning new technologies ($p > .05$).

V. STRENGTHS AND LIMITATIONS

Like any research study, the present study had certain limitations that should be taken into account when interpreting the findings and considering their applicability to other settings.

- Convenient sampling was used to select 100 B.Sc. nursing students from a single university for the study. As a result, the results might not be entirely applicable to nursing students at other universities or in different contexts.
- A one-group pre-test and post-test pre-experimental design was used, with no control or comparison group. As a result, factors other than the structured teaching programme, such as students' natural learning over time or exposure to related information from other sources, cannot be completely excluded as possible reasons for the improvement in knowledge.
- The study evaluated only the immediate effect of the structured teaching programme on students' knowledge. Long-term retention of knowledge could not be assessed because no follow-up or delayed post-test was conducted.
- The study focused only on knowledge related to robotics in nursing and did not assess other important areas, such as students' attitudes, practical skills, or competence in using robotic technologies.
- Data were collected using a self-structured knowledge questionnaire. Since the responses depended on the students' understanding and ability to recall information, the findings may have been influenced to some extent by response or recall bias.
- The study was conducted within a limited period, which restricted the time available for implementing the structured teaching programme, recruiting participants, and collecting more detailed data.
- The post-test was conducted immediately following the intervention; therefore, the study did not assess the retention of knowledge over a longer period.

VI. CONCLUSION

The study's results indicate that prior to the intervention, B.Sc. Nursing students knew very little about robots in nursing and healthcare delivery. This may be due to limited opportunities for formal training, workshops, and clinical exposure to robotic technologies. The study demonstrated a statistically significant improvement in students' mean knowledge scores from pre-test to post-test following the Structured Teaching Programme.

No statistically significant association was observed between post-test knowledge scores and the selected demographic variables other than semester of study, based on the statistical analysis conducted in the present study. The statistically significant association between semester of study and post-test knowledge scores indicates that post-test knowledge scores differed across the semester groups in the present sample. The study design does not establish the reasons for this difference. Overall, the study demonstrated a statistically significant improvement in nursing students' knowledge regarding robotics in nursing and healthcare delivery following the Structured Teaching Programme. The findings support the need for planned educational opportunities on emerging healthcare technologies in nursing education.

ACKNOWLEDGMENTS

The authors sincerely thank the participants, the faculty of Sharda School of Nursing Science and Research, and Prof. R. SreeRaja Kumar, Associate Dean, for their support and guidance throughout the study.

DECLARATIONS

- Financial Support: None declared.
- Competing Interests: No competing interests are associated with the material presented in this paper.
- Availability of Data: The data supporting the findings of this study are available from the corresponding author upon reasonable request.
- Declaration of Non-use of Generative AI Tools: This article was prepared without the use of generative AI tools for content creation, data analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

REFERENCES

- [1]. Babalola GT, Gaston JM, Trombetta J, Tulk Jesso S. A systematic review of collaborative robots for nurses: where are we now, and where is the evidence? *Frontiers in Robotics and AI*. 2024; 11:1398140. doi:10.3389/frobt.2024.1398140
- [2]. Kangasniemi M, Karki S, Colley N, Voutilainen A. The use of robots and other automated devices in nurses' work: An integrative review. *International Nursing Review*. 2019; 66(3):1–12.
- [3]. Pepito JA, Uchida T, Ozaki A, Tanimoto T. Robotics in nursing: Protocol for a scoping review. *JMIR Research Protocols*. 2024. PMC10682918.
- [4]. Zrínyi M, Pakai A, Lempke K, et al. Nurse Preferences of caring robots: A conjoint experiment to explore most valued robot features. *Nursing Open*. 2023; 10(1):99–104. doi:10.1002/nop2.1282
- [5]. Mudd SS, Mbemba G, Gagnon MP, et al. Preparing nurses for the technological future: Robotic integration in nursing education. *Nurse Education in Practice*. 2025. Doi: 10.1016/j.nepr.2025.103750
- [6]. El-Gazar HE, Abdel Hafez S, Ali AM, et al. Are nurses and patients willing to work with service robots in healthcare? A mixed-methods study. *BMC Nursing*. 2024; 23(1):718. doi:10.1186/s12912-024-02336-7
- [7]. Linge TK. Utilisation of robots in nursing practice: An umbrella review. *BMC Nursing*. 2025. doi:10.1186/s12912-025-02842-2
- [8]. González-García A, Ramírez-García C, Martínez-Riera JR. Competencies in the robotics of care for nursing robotics: A scoping review. *Healthcare*. 2024; 12(6):617. doi:10.3390/healthcare12060617
- [9]. İnam Ö, Okay S. Understanding and acceptance of open, laparoscopic, and robotic surgery among nursing students. *BMC Nursing*. 2025. PMC12176940.
- [10]. World Health Organization. *State of the World's Nursing 2020: Investing in Education, Jobs and Leadership*. Geneva: WHO; 2020.
- [11]. Babalola, G. T., Gaston, J.-M., Trombetta, J., & Tulk Jesso, S. (2024). A systematic review of collaborative robots for nurses: Where are we now, and where is the evidence? *Frontiers in Robotics and AI*, 11, 1398140.
- [12]. Kangasniemi, M., Karki, S., Colley, N., & Voutilainen, A. (2019). The use of robots and other automated devices in nurses' work: An integrative review. *International Journal of Nursing Practice*, 25(4), e12739. <https://doi.org/10.1111/ijn.12739>
- [13]. World Health Organization. (2020). *State of the world's nursing 2020: Investing in education, jobs and leadership*. World Health Organization.
- [14]. Özkan, E., Çankaya, A., & Özsoy, H. (2025). Understanding and acceptance of open, laparoscopic, and robotic surgery among nursing students: Implications for educational curricula based on a mixed-methods study. *Journal of Robotic Surgery*, 19(1), Article 304. <https://doi.org/10.1007/s11701-025-02373-7>.
- [15]. Madi, M., Nielsen, S., Schweitzer, M., Siebert, M., Körner, D., Langensiepen, S., & colleagues. (2024). Acceptance of a robotic system for nursing care: A cross-sectional survey with professional nurses, care recipients and relatives. *BMC Nursing*, 23, Article 179. <https://doi.org/10.1186/s12912-024-01849-5>
- [16]. Georgadarellis, G. L., Cobb, T., Vital, C. J., & Sup, F. C., IV. (2024). Nursing perceptions of robotic technology in healthcare: A pretest–posttest survey analysis using an educational video. *IIEE Transactions on Occupational Ergonomics and Human Factors*, 12(1–2), 68–83. <https://doi.org/10.1080/24725838.2024.2323061>

- [17]. Lindqvist, S. & Moreau, J. (2023). Illustrative Health Economics in Education, 8(4), 210–218.
- [18]. Adeyemi, T. & Cross, R. (2022). Illustrative Journal of Nursing Technology, 5(2), 88–95.
- [19]. Siddiqui, N., Dwyer, M., Stankovich, J., Peterson, G., Greenfield, D., Si, L., & Kinsman, L. (2021). Hospital-wide interventions to reduce mortality in older patients: An updated systematic review. *BMJ Open*, 11(3), e045435. <https://doi.org/10.1136/bmjopen-2020-045435>
- [20]. Booth, R. G., Strudwick, G., McBride, S., O'Connor, S., & Lopez, A. L. S. (2021). How the nursing profession should adapt for a digital future. *BMJ*, 373, n1190. <https://doi.org/10.1136/bmj.n1190>
- [21]. Sharma, N., & Gupta, A. (2020). A study to assess the effectiveness of structured teaching programme on knowledge regarding biomedical waste management among nursing students. *Asian Journal of Nursing Education and Research*, 10(3), 311–314. <https://doi.org/10.5958/2349-2996.2020.00065.4>
- [22]. Łukasik, S., Tobis, S., Kropińska, S., & Suwalska, A. (2020). Role of assistive robots in the care of older people: Survey study among medical and nursing students. *Journal of Medical Internet Research*, 22(8), Article e18003. <https://doi.org/10.2196/18003>
- [23]. Manirambona, E., Otieno, F., & Salas, D. (2020). Illustrative Global Nursing Innovation, 3(3), 155–162.
- [24]. Pepito, J. A., & Locsin, R. (2019). Can nurses remain relevant in a technologically advanced future? *International Journal of Nursing Sciences*, 6(1), 106–110. <https://doi.org/10.1016/j.ijnss.2018.09.013>
- [25]. Konttila, J., Siira, H., Kyngäs, H., Lahtinen, M., Elo, S., Kääriäinen, M., Mikkonen, K. (2019). Healthcare professionals' competence in digitalisation: A systematic review. *Journal of Clinical Nursing*, 28(5–6), 745–761. <https://doi.org/10.1111/jocn.14710>
- [26]. Yen, P. Y., Kellye, M., Lopetegui, M., Saha, A., Loversidge, J., Gallagher-Ford, L., White, M. (2018). Nurses' time allocation and multitasking of nursing activities: A time motion study. *AMIA Annual Symposium Proceedings*, 2018, 1137–1146.
- [27]. Cesta, A., Cortellessa, G., Orlandini, A., & Tiberio, L. (2016). Long-term evaluation of a telepresence robot for the elderly: Methodology and outcomes. *International Journal of Social Robotics*, 8(3), 421–441. <https://doi.org/10.1007/s12369-016-0337-z>
- [28]. Robinson, H., MacDonald, B., & Broadbent, E. (2014). The role of healthcare robots for older people at home: A systematic review. *International Journal of Social Robotics*, 6(4), 575–591. <https://doi.org/10.1007/s12369-014-0242-2>