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"Impact of skill training programme on knowledge and skills of nursing students regarding uses of instruments and devices in intensive care unit: A systematic review."

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Abstract

Background: The dynamic and technologically advanced environment of the Intensive Care Unit (ICU) demands well-equipped nursing professionals who are proficient in using critical care instruments and devices. Ensuring nursing students are adequately trained in this domain is essential for patient safety and quality care delivery. This study aimed to assess the effectiveness of a structured skill training programme on the knowledge and skills of nursing students regarding the use of instruments and devices in the ICU at a tertiary care hospital in Vadodara.

Methodology: A quasi-experimental research design with a one-group pre-test and post-test approach was employed. The study participants included nursing students enrolled at a tertiary institution. A comprehensive review of 30 relevant national and international studies guided the development of the training intervention and assessment tools. The literature was categorized into three sections: effectiveness of skill training programmes, knowledge and skills of nursing students, and the usage of ICU instruments and devices.

Findings: The literature review highlighted significant improvements in knowledge and skills following targeted training interventions, including simulation-based education, procedural demonstrations, and video-assisted learning. Notably, studies reported enhanced confidence, clinical competence, and reduced procedural errors post-training. This evidence underlined the effectiveness of practical and simulated training methods in critical care education.

Conclusion: The findings from both literature and the present study affirm that skill training programmes substantially improve the knowledge and practical competencies of nursing students in ICU settings. Implementing structured, simulation-supported training can bridge the gap between theoretical knowledge and clinical application, thereby preparing students for real-world critical care challenges.

Keywords: Skill training, ICU instruments, nursing education, critical care, simulation, clinical competence, nursing students

1. INTRODUCTION:

The expertise, equipment, and understanding needed to care for patients in critical condition have greatly increased during the past few decades. In order to treat critically ill patients, intensive care units (ICUs) were created. These are essentially places where patients who are very sick can receive the care they need along with the resources and knowledge needed to address their condition. Dedicated to the treatment of severely sick patients, injuries, or problems, the intensive care unit (ICU) is a highly specialized and complex area of a hospital that is planned, staffed, situated, furnished, and equipped.[1]

Furthermore, using up-to-date, advanced medical equipment familiarizes nursing students with current healthcare technologies, promoting adaptability and competence. Practicing in a safe and supervised setting also minimizes errors and improves patient safety. In summary, proper equipment and instruments are indispensable in nursing education as they play a key role in building clinical competence, confidence, and professionalism, which are essential for delivering high-quality patient care in diverse healthcare settings.

In order to conduct the present study on assessing the knowledge, and skills regarding the use of ICU instruments and devices among nursing students, the researcher undertook an extensive review of existing literature. Various sources were explored to gain comprehensive insights and support the research framework. These included textbooks, printed journals, and electronic resources. Reputable online databases such as MEDLINE (Medical Literature Analysis and Retrieval System Online), CINAHL (Cumulative Index to Nursing and Allied Health Literature), PubMed, and Google Scholar were utilized to access relevant and up-to-date scholarly articles, research studies, and reviews. The literature review helped in identifying research gaps, understanding existing findings, and shaping the objectives and methodology of the current study.

2. MATERIAL AND METHOD AND FINDINGS

The study primarily aimed to assess the effectiveness of a skill training programme on the knowledge and skills of nursing students concerning the use of instruments and devices in the intensive care unit at a tertiary care hospital in Vadodara. To build a strong foundation for the study framework, the researcher conducted an extensive review of around 30 relevant literature sources. Based on the insights gathered, these sources were systematically categorized into three distinct groups as mentioned-

Section A: Review of literature related to the effectiveness of skill training programme on knowledge and skills among nursing students.

Section B: Review of literature related to knowledge and skills among nursing students.

Section C: Review of literature related to uses of instruments and devices in intensive care unit among nursing students.

Author: Rumysa Yousuf et al.	**Objectives:** To assess the effectiveness of a skill	**Methodology:** Pre-experimental one-group pre-	**Result:** Knowledge increased from 56.7% to 100%, skills from 76.7% to 100%.

Year: 2022 **Country:** Kashmir, India	training program on Ryles tube insertion and feeding.	test post-test design; 30 BSc Nursing students selected via convenience sampling.	Significant improvement in post-test scores. **Conclusion:** The training program effectively enhanced knowledge and skills related to Ryles tube insertion.
Author: Elisabeth Solvik et al. **Year:** 2018 **Country:** Norway	**Objectives:** To assess student satisfaction with bed bath training before clinical placements.	**Methodology:** Cross-sectional design; 160 first-year students; two training sessions, two questionnaires six months apart.	**Result:** 47% felt underprepared; 85% felt confident after training. **Conclusion:** Clinical practice reinforced training, enhancing real-world application.
Author: Francesco Gravante et al. **Year:** 2022 **Country:** Italy	**Objectives:** To evaluate training on detecting patient-ventilator asynchronies (PVA).	**Methodology:** Pre-test/post-test with fourth-year nursing students; assessments at T0, T1, T2.	**Result:** 67.5% accurately detected PVAs post-training **Conclusion:** Training improved recognition of PVAs and waveform analysis skills.
Author: **Riitta-**Liisa Lakanmaa et al. **Year:** 2014 **Country:** Finland	**Objectives:** To assess ICU nursing competence among graduating students.	**Methodology:** **Cross-sectional survey; 139 students; self-assessment and knowledge tests.**	**Result:** 69% rated their competence as good; no link between self-rating and test scores. **Conclusion:** Emphasized the need for both knowledge and self-evaluation skills.
Author: Fereshte Montazer et al. **Year:**	**Objectives:** To assess dimensional analysis in drug	**Methodology:** Quasi-experimental; pre-post test; intervention vs.	**Result:** Significant improvement in drug calculation skills in intervention group. **Conclusion:**

2022 **Country:** Iran	calculation skills.	control group.	Dimensional analysis training was effective in ICU drug calculations.
Author: Francesco Gravante et al. **Year:** 2020 **Country:** Italy	**Objectives:** To evaluate a training program on PVA detection.	**Methodology:** One-group pre-test/post-test with follow-up; 25 students.	**Result:** Significant skill improvement post-training and after one month. C**onclusion:** Targeted training effectively improved detection of PVA.
Author: Sara Shahbazi et al. **Year:** 2019 **Country:** Iran	**Objectives:** To assess the effect of problem-solving training on emotional intelligence.	**Methodology:** Case-control; 43 final-year students; pre/post tests.	**Result:** Improved emotional intelligence scores in intervention group. C**onclusion:** Problem-solving training enhanced emotional skills and professional readiness.
Author: Akoijam Mamata Devi et al. **Year:** 2021 **Country:** India	**Objectives:** To evaluate a skill training program on postnatal care for LSCS mothers.	**Methodology:** Quasi-experimental; 30 students each in experimental and control groups.	**Result:** Significant improvement in knowledge and skills post-training. C**onclusion:** Skill training enhanced clinical competencies and communication skills.
Author: Sandra Saldanha et al. **Year:** 2021 **Country:** India	**Objectives:** To assess effectiveness of simulation training on urinary catheter insertion.	**Methodology:** One-group pre-test/post-test; 57 BSc Nursing students.	**Result:** Skill scores improved significantly post-training. C**onclusion:** Simulation-based training effectively improved procedural skills.
Author: Annamma	**Objectives:** To evaluate video-	**Methodology:** Cross-	**Result:** High satisfaction and

Kunjukunju et al. **Year:** 2023 **Country:** India	based skill training in nursing education.	sectional; 108 diploma students; analyzed with SPSS.	positive attitudes toward video-based training. **Conclusion:** Video training is effective but needs better content delivery for skill improvement.
Author: Baljit Kaur et al. **Year:** 2015 **Country:** India	**Objectives:** To enhance airway management skills through simulation.	**Methodology:** Observational; 60 students in 20 groups; repeated training after 12 weeks.	**Result:** Performance improved from 35% to 100% proficiency. **Conclusion:** Simulation greatly improved airway management skills.
Author: B.R. Sumangala et al. **Year:** 2023 **Country:** India	**Objectives:** To evaluate training effectiveness on bandaging techniques.	**Methodology:** Pre-experimental one-group pre/post-test; 40 paramedical students.	**Result:** Significant improvements in knowledge and skill post-training. **Conclusion:** Training enhanced both theoretical and practical competencies.
Author: Manizheh Bakhshi et al. **Year:** 2023 **Country:** Iran	**Objectives:** To compare practical training vs. integrated simulated-practical training on ventilator knowledge and skills.	**Methodology:** Quasi-experimental; 72 students, two groups, pre-post SPSS analysis.	**Result:** Both groups improved in knowledge; simulation group had faster adjustment time and higher skill scores. **Conclusion:** Integrated simulation enhances ventilator proficiency and is recommended for training.
Author: Gauri D. Kawanpure et al. **Year:** 2023 **Country:** India	**Objectives:** To assess the effectiveness of simulation-based training on I-gel ventilation skills.	**Methodology:** Pre-experimental, one-group pre-post test, 60 B.Sc. students.	**Result:** 50% improvement in knowledge and skills. **Conclusion:** Simulation improves confidence and clinical competency.

Author: Bruna P. Canever et al. **Year:** 2022 **Country:** Brazil	**Objectives:** To explore simulation's role in skill development.	**Methodology:** Qualitative, exploratory; 25 students; thematic analysis.	**Result:** Simulation enhanced critical thinking, self-awareness, and competency. **Conclusion:** Simulation is vital for skill mastery and competency development.
Author: Maysa F. Kassabry et al. **Year:** 2023 **Country:** Palestine	**Objectives:** To evaluate HFS impact on ACLS training.	**Methodology:** Quasi-experimental, 60 students; pre-post with RSES, SAI, attitude tools.	**Result:** Improved self-efficacy, attitude, and reduced anxiety. **Conclusion:** HFS is effective in enhancing ACLS learning outcomes.
Author: Ru-Yu Lien et al. **Year:** 2023 **Country:** Taiwan	**Objectives:** To evaluate ICU simulation's impact on nurse learning.	**Methodology:** Pre-post assessments (knowledge, empathy, skills); Wilcoxon, chi-square.	**Result:** Significant improvements in all learning domains. **Conclusion:** In situ simulation enhances ICU nursing skills and holistic care.
Author: Paul Wambugu et al. **Year:** 2022 **Country:** Kenya	**Objectives:** To assess CPR skill level among senior nursing students.	**Methodology:** Cross-sectional; 175 students; SPSS analysis using AHA tools.	**Result:** Mean score 27%, below standard. **Conclusion:** Need for certified CPR refresher training and AED inclusion.
Author: Young-Ju Son et al. **Year:** 2015 **Country:** South Korea	**Objectives:** To identify essential ICU nursing skills.	**Methodology:** Cross-sectional; 111 nurses, 168 students; survey analysis.	**Result:** Identified top 25% core ICU skills; 9 aligned with curriculum. **Conclusion:** Revise ICU skill curriculum based on practical

			relevance.
Author: Roghieh Nazari et al. **Year:** 2013 **Country:** Iran	**Objectives:** To assess the effect of DOPS on skill learning.	**Methodology:** Quasi-experimental; 39 students; pre-post skill checklists.	**Result:** Significant post-test score improvement in DOPS group. **Conclusion:** DOPS enhances ICU procedural skills; recommended in clinical teaching.
Author: Karsten J. Roberts et al. **Year:** 2022 **Country:** USA	**Objectives:** To evaluate tele-ICU's impact on ventilator knowledge.	**Methodology:** One-group pre-post design; 71 students; surveys.	**Result:** Significant confidence and knowledge gains, especially in COVID care. **Conclusion:** Tele-ICU rotation improves ventilator management confidence.
Author: Merve Özsoy Durmaz et al. **Year:** 2023 **Country:** Turkey	**Objectives:** To assess knowledge of robotic surgery among nursing students.	**Methodology:** Descriptive study; 478 students; questionnaire-based.	**Result:** 73% reported partial knowledge; tech interest was high. **Conclusion:** More education on robotic surgery is needed for tech integration.
Author: Rafi M. Alnjadat et al. **Year:** 2023 **Country:** Jordan	**Objectives:** To assess competence in preoperative care.	**Methodology:** Cross-sectional; 202 students; PPreCC-NS tool.	**Result:** Adequate competence; strongest in ethics, weakest in research. **Conclusion:** Overall competence is fair; influenced by residency.
Author: Ayla I. Aydin et al. **Year:** 2019 **Country:** Turkey	**Objectives:** To determine knowledge about neonatal oxygen therapy.	**Methodology:** Descriptive; 89 students; questionnaire.	**Result:** High knowledge, especially among females. **Conclusion:** Good knowledge, but gender gap observed.
Author: Ivan	**Objectives:** To	**Methodology:**	**Result:** Theory was

Rubbi et al. **Year:** 2021 **Country:** Italy	evaluate ECG knowledge and skill.	Comparative; 76 participants (students & nurses); questionnaires.	good, practical skills weaker. **Conclusion:** More ECG practical training is needed.
Author: Benyaporn Bannaasan et al. **Year:** 2020 **Country:** Thailand	**Objectives:** To assess wound dressing skill using latex model.	**Methodology:** Quasi-experimental; 60 students; skill checklists.	**Result:** Improved skills in experimental group. **Conclusion:** Latex model enhances wound dressing competencies.
Author: BV Doğru et al. **Year:** 2020 **Country:** Turkey	**Objectives:** To compare simulation vs. traditional teaching in cardiac auscultation.	**Methodology:** RCT; 72 students; pre-post tests.	**Result:** Simulation group showed higher knowledge, skills, lower anxiety. **Conclusion:** High-fidelity simulation is superior for skill development.
Author: M. Peddle et al. **Year:** 2019 **Country:** Australia	**Objectives:** To explore impact of virtual patients on non-technical skills (NTS).	**Methodology:** Case study; 71 students; focus groups, interviews.	**Result:** Improved communication, decision-making, and stress management. **Conclusion:** Virtual patients support development of critical NTS.
Author: C. Ahlin et al. **Year:** 2017 **Country:** Sweden	**Objectives:** To assess venepuncture and catheter insertion skills.	**Methodology:** Descriptive; performance checklists; correlation analysis.	**Result:** High procedural accuracy; linked to self-training. **Conclusion:** Encourage self-training to boost skill proficiency.
Author: R. Abajas-Bustillo et al.	**Objectives**: To evaluate EOL simulation for	**Methodology:** Descriptive; 130 students;	**Result:** Improved emotional processing and dialogue skills.

Year: 2020 **Country:** Spain	communication skills.	simulation + evaluation tool.	C**onclusion:** HFS enhances EOL communication among nursing students.
Author: Manizheh Bakhshi et al. **Year:** 2023 **Country:** Iran	**Objectives:** To compare the effectiveness of practical vs. integrated simulated-practical ventilator training for nursing students.	**Methodology:** Quasi-experimental study with 72 students randomly assigned to two groups. Knowledge, skill scores, and adjustment time were assessed.	**Result:** Both groups showed improved knowledge (no significant difference), but the integrated group had faster adjustment time (366.24 s vs. 418.32 s) and higher skill scores (29.88 vs. 28.34). C**onclusion:** Integrated simulated-practical training enhanced skill acquisition and efficiency, supporting its use in ventilator education.
Author: Tobias Grundgeiger et al. **Year:** 2022 **Country:** Iraq	**Objectives:** To evaluate the effectiveness of combining e-Learning with hands-on practice in syringe pump training for nursing students.	**Methodology:** Quasi-experimental study comparing e-Learning alone vs. e-Learning with hands-on training. Procedural skills and confidence were assessed across immediate and follow-up sessions.	**Result:** No significant differences were found between groups in procedural skills ($p = 0.128$) or confidence ($p = 0.570$). However, confidence significantly declined from immediate to follow-up sessions ($p < 0.001$). C**onclusion:** Blending e-Learning with hands-on practice did not significantly improve skills or sustained confidence, though confidence was initially higher post-training. Further studies are needed to

			assess long-term outcomes.
Author: Bandu Sharma et al. **Year:** 2023 **Country:** India	**Objectives:** To assess the effectiveness of a nursing care protocol on nurses' knowledge and practices in caring for children on mechanical ventilators.	**Methodology:** Structured pre-test/post-test design using a knowledge questionnaire and observational checklist. Post-intervention assessment was done after 7 days.	**Result:** Significant improvement observed in knowledge (mean increase: 8.9; t = 8.217) and practice scores (mean increase: 3.3; t = 11.60) after protocol implementation. **Conclusion:** The nursing care protocol effectively enhanced nurses' knowledge and practices in child mechanical ventilator care.
Author: Bharti Sharma et al. **Year:** 2020 **Country:** India	**Objectives:** To evaluate the effectiveness of a planned teaching program on ventilator care bundle knowledge among B.Sc. Nursing 3rd year students.	**Methodology:** Pre-experimental one-group pre-test/post-test design based on General System Theory; 60 students assessed using a self-structured questionnaire before and 7 days after a PowerPoint-based teaching session.	**Result:** Knowledge scores increased significantly from 48.06% (pre-test) to 71.5% (post-test). Demographic variables showed no significant association with knowledge levels. **Conclusion:** The planned teaching program effectively improved nursing students' knowledge regarding the ventilator care bundle for preventing ventilator-associated pneumonia.
Author: Uma Deaver et al. **Year:** 2022 **Country:**	**Objectives:** To assess the effectiveness of conventional training (CT)	**Methodology:** Quasi-experimental design with a non-equivalent control group	**Result:** Both groups showed significant improvement in post-test scores. No significant difference was found between CT

	versus virtual-assisted training (VAT) on knowledge and practices related to neonatal endotracheal (ET) intubation among nursing students.	pre-test/post-test; 64 third-year B.Sc. Nursing students were divided into CT and VAT groups (n=32 each). Knowledge and practice were measured using questionnaires and checklists.	and VAT in knowledge (t = 0.38) or practice (t = 1.90) scores. **Conclusion:** CT and VAT were equally effective in improving knowledge and practice regarding neonatal ET intubation. Combining both methods can enhance skill development in nursing education.
Author: **Ruting Gu et al.** **Year:** 2022 **Country:** China	**Objectives:** To evaluate the effectiveness of a game-based mobile application in improving venous catheter flushing and locking skills among nursing students.	**Methodology:** Single-blind randomized controlled trial with 154 nursing students (77 in experimental group and 77 in control). All received standardized training; the experimental group used a mobile app for 7 days for additional practice.	**Result:** The experimental group showed significantly higher skill scores (p = 0.003) and lower error rates in various procedure components (p < 0.05) than the control group. **Conclusion:** Game-based mobile apps are effective short-term tools for enhancing nursing students' practical skills and reducing procedural errors in catheter care.
Author: Salameh Basma et al. **Year:** 2021 **Country:** Iran	**Objectives:** To assess the impact of High-Fidelity Simulation (HFS) involving Mechanical Ventilation on nursing	**Methodology:** Quasi-experimental design with 151 undergraduate nursing students. The Lasater Clinical	**Result:** The intervention group showed significantly higher clinical knowledge (t = 20.42; p = .001) and clinical judgment scores (t = 19.55; p < .001) compared to the control group.

	students' clinical knowledge and judgment.	Judgment Rubric was used to assess outcomes post-intervention.	C**onclusion**:Integrating HFS with mechanical ventilation scenarios significantly enhances clinical knowledge, judgment, critical thinking, and decision-making in nursing students.
Author: M. Otero-Agra et al. **Year:** 2021 **Country:** China	**Objectives:** To assess CPR performance using mouth-to-mouth ventilation (MMV) and bag-valve-mask ventilation (BMV) on adult and infant manikins by nursing students after theoretical and practical training.	**Methodology:** Quasi-experimental randomized cross-over design with 44 nursing students. Participants received 5 hours of CPR training and performed four 4-minute CPR tests one month later using both MMV and BMV on adult and infant manikins.	**Result:** Chest compression quality was consistent across tests. However, MMV showed significantly higher effective ventilation rates than BMV in both adult (MMV: 98%, BMV: 84%, p = 0.003) and infant (MMV: 97%, BMV: 76%, p = 0.001) manikins. CPR quality was superior with MMV in infant scenarios ($p < 0.001$). C**onclusion:** Nursing students performed better with MMV than BMV. The study highlights the difficulty in mastering BMV and recommends incorporating complementary training strategies to enhance BMV skills.
Author: E. O'Currain et al. **Year:** 2019 **Country:**	**Objectives:** To evaluate the effectiveness of real-time feedback	**Methodology:** Stratified, parallel-group randomized controlled trial	**Result:** The visible RFM group showed significantly reduced facemask leak compared to the

Australia	monitors (RFM) during newborn ventilation training.	with 400 healthcare professionals in 13 hospitals; participants randomized to either visible or masked RFM display groups during 1.5-hour newborn ventilation simulation.	masked group. C**onclusion:** Visible RFM displays enhance the effectiveness of newborn facemask ventilation training by improving technique and reducing leakage.

3. DISCUSSION

Given these gaps, it becomes evident that there is a need to evaluate the effectiveness of skill-based training interventions—especially in the context of critical care nursing. Therefore, the present systematic review aims to synthesize available evidence on the **impact of skill training programmes on the knowledge and skills of nursing students regarding the use of instruments and devices in the intensive care unit (ICU)**.

4. CONCLUSION

This review will help identify best practices, educational strategies, and training modalities that effectively enhance clinical competence in ICU settings. A review of existing literature indicates that the majority of studies reported positive outcomes regarding the **impact of skill training programmes on the knowledge and skills of nursing students in using instruments and devices in intensive care units**, highlighting overall satisfaction and improved competency levels.

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