

Preliminary Effects of a Video-Assisted Teaching Module on Knowledge and IV Flushing Skills among Staff Nurses: A Pilot Study

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Abstract

Background: Intravenous (IV) catheter flushing is a routine component of vascular access care and requires appropriate knowledge and technical competence to support safe clinical practice. Video-assisted teaching has emerged as a useful educational approach for teaching clinical and psychomotor skills in nursing. Before undertaking a larger study, it is important to determine whether the proposed methodology, intervention, research tools, and assessment procedures are feasible and practical.

Objective: This pilot study aimed to assess the feasibility of the proposed study methodology and the practicality of the research tools and procedures, while obtaining preliminary evidence regarding changes in knowledge and IV flushing skills among staff nurses following a Video-Assisted Teaching Module (VATM).

Methods: A one-group pre-test–post-test pilot study was conducted among 30 staff nurses working in a tertiary-care hospital in Kolkata, West Bengal. Participants were assessed using a demographic proforma, a Structured Knowledge Questionnaire, and a 22-step IV Flushing Skill Observation Checklist. The VATM consisted of an educational video incorporating theoretical content and demonstration of the IV flushing procedure. Participants also provided feedback regarding the teaching module. Data collection was conducted over three days: baseline assessment on Day 1, administration of the VATM and feedback collection on Day 2, and post-test assessment on Day 3. Descriptive statistics and paired-sample t-tests were used for analysis.

Results: The mean knowledge score increased from 23.17 ± 3.69 at pre-test to 27.17 ± 2.34 at post-test, with a mean increase of 4.00 points ($t = 5.50$, $p < 0.001$). The proportion of participants achieving the predetermined knowledge pass mark increased from 33.3% to 83.3%. Mean skill performance improved from 14.43 ± 3.75 to 19.77 ± 3.27 out of 22 steps ($t = 8.13$, $p < 0.001$). The mean number of red flags decreased from 3.53 ± 1.59 to 0.97 ± 1.40 ($p < 0.001$). The study procedures and assessment tools were feasible to administer, and participant feedback indicated generally positive acceptance of the VATM.

Conclusion: The pilot study demonstrated that the proposed methodology, data collection procedures, and assessment tools were practical for implementation. Preliminary findings suggest that the VATM may improve nurses' knowledge and IV flushing skills. However, the findings should not be interpreted as definitive evidence of intervention effectiveness because of the pilot design and small sample size. The results provide useful information for planning a larger study.

Keywords: intravenous catheter flushing (IV flushing); video-assisted teaching module (VATM); nursing education; clinical skills; knowledge; pilot study; vascular access

1. Introduction

Intravenous therapy is an essential component of modern healthcare, and peripheral and other vascular access devices are frequently used for the administration of fluids, medications, blood products, and other therapies. Appropriate maintenance of IV access is therefore an important responsibility of nurses involved in direct patient care.

IV catheter flushing is a routine procedure performed to maintain catheter patency and support safe vascular access management. Although flushing may appear to be a simple clinical procedure, safe performance requires appropriate understanding of the procedure, adherence to recommended practices, and competence in each step. Inconsistent knowledge or variations in technique may affect the quality and safety of vascular access care. Evidence-based infusion and vascular access standards therefore emphasize the importance of competency development and consistent clinical practice among healthcare professionals.

Nurses are expected to acquire and maintain both theoretical knowledge and psychomotor competence. Traditional teaching methods alone may not always provide learners with an opportunity to repeatedly observe a clinical procedure. Video-assisted teaching offers a visual and structured method through which theoretical concepts and practical procedures can be presented together.

Previous reviews have suggested that video-based learning can support the acquisition of clinical and psychomotor skills in nursing. A systematic review and meta-analysis reported that video was a beneficial teaching method for psychomotor skill development in nursing, with several included studies demonstrating improved clinical performance. Reviews of video-supported and blended learning have also highlighted the potential benefits of combining theoretical instruction with visual demonstration and skills-based learning.

However, before conducting a larger study evaluating an educational intervention, it is important to establish whether the proposed methodology can be implemented successfully. Pilot studies help researchers assess the feasibility of recruitment, data collection, intervention delivery, assessment procedures, and the practical use of research instruments. They can also provide preliminary information about potential changes following an intervention.

The present study was therefore undertaken as a pilot study to assess whether the proposed methodology, research tools, and procedures could be practically implemented among staff nurses. In addition, the study obtained preliminary evidence regarding changes in nurses' knowledge and IV flushing skills following exposure to a Video-Assisted Teaching Module (VATM).

2. Objectives

The objectives of the pilot study were:

- To assess the feasibility of the proposed research methodology and study procedures.
- To determine the practicality of using the Structured Knowledge Questionnaire and IV Flushing Skill Observation Checklist.

3. Materials and Methods

3.1 Study Design

A quantitative one-group pre-test–post-test pilot study design was used.

The pilot study was conducted primarily to pre-assess the feasibility of the proposed research methodology. This included evaluating the practicality of the research tools, the implementation of the intervention, the sequence of data collection, and the assessment procedures. Preliminary changes in knowledge and skill following the intervention were also examined.

3.2 Study Setting

The study was conducted in a tertiary-care hospital in Kolkata, West Bengal, India.

The name of the hospital has not been disclosed in accordance with institutional instructions.

3.3 Study Population

The study population consisted of registered nurses working in clinical areas of the selected tertiary-care hospital.

3.4 Sample Size

A total of 30 staff nurses participated in the pilot study.

The sample size was considered appropriate for the preliminary purpose of evaluating the feasibility and practicality of the proposed methodology and generating preliminary outcome data.

3.5 Sampling Technique

Participants were selected using a convenient sampling technique based on their availability and willingness to participate during the data collection period.

3.6 Inclusion Criteria

The study included:

- Registered nurses with professional qualifications such as GNM, B.Sc. Nursing, P.B.B.Sc. Nursing, or M.Sc. Nursing.
- Nurses currently working in clinical departments such as General Wards, ICUs, Emergency Department, OT, or Recovery Units.
- Nurses aged between 21 and 60 years.
- Nurses with a minimum of six months of clinical experience.
- Nurses willing to provide informed consent.
- Nurses available during the period of data collection.
- Nurses able to read and understand English.

3.7 Exclusion Criteria

The study excluded:

- Nurses not directly involved in intravenous therapy procedures.
- Nurses on extended leave.
- Nurses assigned exclusively to administrative roles without direct patient care responsibilities.
- Nurses who declined participation or did not provide informed consent.
- Nurses unavailable during the data collection period.

3.8 Description of the Study Instruments

Tool I: Demographic Proforma

The demographic proforma was used to collect information regarding:

- Gender

- Age
- Primary source of information about the PUSH & PAUSE flushing technique
- Professional qualification
- Department of work
- Clinical experience

Tool II: Structured Knowledge Questionnaire

- A structured questionnaire consisting of 30 items was used to assess nurses' knowledge regarding IV catheter flushing.
- Each correct response was awarded a score of 1, while an incorrect response was awarded 0.
- The maximum possible score was 30.
- A score of 26 or above was considered to meet the predetermined pass mark.

Tool III: IV Flushing Skill Observation Checklist

- A 22-step observation checklist was used to assess practical IV flushing performance.
- Skill assessment was conducted during performance of the procedure on a mannequin in the skill station.

The assessment included:

- Number of steps completed
- Presence of red flags
- Overall skill grade

The grading categories were:

Grade	Performance
A	22 steps completed, no red flags; able to perform without supervision
B	19–21 steps completed, 1 red flag; requires minimal supervision
C	16–18 steps completed, 2–3 red flags; requires supervision
D	<16 steps completed, >3 red flags; unable to perform independently

Tool IV: VATM Feedback Questionnaire

A feedback questionnaire was used to obtain participants' responses regarding the Video-Assisted Teaching Module.

The questionnaire assessed different aspects of the VATM, including participants' responses to the educational content and presentation.

3.9 Intervention: Video-Assisted Teaching Module

The intervention consisted of a Video-Assisted Teaching Module (VATM) on IV catheter flushing.

The educational content was incorporated within the video itself. The video included theoretical information presented in a PowerPoint-based format along with visual demonstration of the IV flushing procedure.

Thus, the intervention was delivered as a single integrated video-based teaching module, rather than as separate PowerPoint and video sessions.

3.10 Procedure of the Pilot Study

Data collection for the pilot study was conducted in December 2023.

Day 1: Baseline Assessment**On the first day:**

- Participants were informed about the purpose and procedure of the study.
- Written informed consent was obtained.
- Demographic information was collected.
- Baseline knowledge was assessed using the Structured Knowledge Questionnaire.
- Baseline IV flushing skills were assessed using the 22-step Skill Observation Checklist.
- Skill performance was observed during practice at the skill station using a mannequin.

Day 2: Administration of VATM and Feedback**On the second day:**

- The Video-Assisted Teaching Module on IV catheter flushing was administered.
- The video included both theoretical content and visual demonstration of the procedure.
- Participants completed the feedback questionnaire following exposure to the VATM.

Day 3: Post-Test Assessment**On the third day:**

- Participants completed the post-test knowledge assessment using the same Structured Knowledge Questionnaire.
- IV flushing skills were reassessed using the same 22-step Skill Observation Checklist.
- Skill performance was again assessed during practice on a mannequin at the skill station.

3.11 Ethical Considerations

Ethical principles were maintained throughout the study to protect participants' rights, dignity, safety, and well-being. Ethical clearance was obtained from the Institutional Ethics Committee (IEC), and permission was secured from the concerned administrative authorities before data collection. Written informed consent was obtained from all participants. Participation was voluntary, and participants could withdraw at any time without penalty. Privacy, anonymity, and confidentiality were maintained, with no personal identifiers recorded. All data were securely stored and used solely for research purposes.

3.12 Data Analysis

Data were entered and analyzed using descriptive and inferential statistics.

Descriptive statistics included:

- Frequency
- Percentage
- Mean
- Standard deviation

Paired-sample t-tests were used to compare:

- Pre-test and post-test knowledge scores.
- Pre-test and post-test skill performance scores.
- Pre-test and post-test red flag scores.

Statistical significance was considered at $p < 0.05$

4. Results

4.1 Demographic Characteristics of Participants

Table 4.1.1 Demographic Characteristics of Participants (N = 30)

Variable	Category	Frequency	Percentage
Gender	Male	7	23.3
	Female	23	76.7
Age	21–30 years	18	60
	31–40 years	12	40
Primary source of information about the PUSH & PAUSE flushing technique	Academic education	18	60
	Clinical experience	12	40
Professional qualification	GNM	17	56.7
	B.Sc. Nursing	13	43.3
Department	General ward	14	46.7
	ICU	9	30
	Emergency	3	10
	OT and Recovery	4	13.3
Clinical experience	0–5 years	21	70
	6–10 years	9	30

Interpretation: Most participants were female (76.7%). Sixty percent were aged between 21 and 30 years. Academic education was the primary source of information about the PUSH & PAUSE flushing technique for 60.0% of participants, while 40.0% reported clinical experience as their primary source of information. More than half of the participants were GNM-qualified nurses, and the largest proportion worked in general wards. Most participants had between 0 and 5 years of clinical experience.

4.2 Knowledge Assessment

Table 4.2.1 Distribution of Pre-Test Knowledge Scores (N=30)

Performance	Frequency	Percentage
Pass (≥ 26)	10	33.3
Below pass mark (< 26)	20	66.7
Total	30	100

Interpretation: The median possible score was 30, and the predetermined pass mark was 26. Only one-third of the participants achieved the predetermined pass mark before receiving the Video-Assisted Teaching Module. The mean pre-test knowledge score was: 23.17 ± 3.69

Table 4.2.2 Distribution of Post-Test Knowledge Scores (N=30)

Performance	Frequency	Percentage
Pass (≥ 26)	25	83.3
Below pass mark (< 26)	5	16.7
Total	30	100

Interpretation: The mean post-test knowledge score was: 27.17 ± 2.34 . Following the Video-Assisted Teaching Module, 83.3% of participants achieved the predetermined knowledge pass mark.

Table 4.2.3 Comparison of Pre-Test and Post-Test Knowledge Scores (N = 30)

Assessment	Mean	SD	Mean Difference	Paired t	p-value
Pre-test	23.17	3.69	4	5.5	<0.001
Post-test	27.17	2.34			

Interpretation: There was an increase in the mean knowledge score from 23.17 during the pre-test to 27.17 during the post-test. The mean increase was **4.00 points**. The paired-sample t-test showed a statistically significant difference between pre-test and post-test knowledge scores ($t = 5.50$, $p < 0.001$).

4.3 IV Flushing Skill Assessment

Table 4.3.1 Distribution of Pre-Test Skill Grades (N = 30)

Grade	Interpretation	Frequency	Percentage
A	Can perform without supervision	0	0
B	Can perform with minimal supervision	2	6.7
C	Can perform with supervision only	14	46.7
D	Cannot perform	14	46.7
Total		30	100

Interpretation: Before the intervention, none of the participants achieved Grade A. Almost half of the participants required supervision to perform the procedure, while another 46.7% were categorized as unable to perform the procedure according to the predefined assessment criteria. The mean number of completed steps was: 14.43 ± 3.75 out of 22. The mean number of red flags was: 3.53 ± 1.59

Table 4.3.2 Distribution of Post-Test Skill Grades (N = 30)

Grade	Interpretation	Frequency	Percentage
A	Can perform without supervision	17	56.7
B	Can perform with minimal supervision	5	16.7
C	Can perform with supervision only	6	20
D	Cannot perform	2	6.7
Total		30	100

Interpretation: Following the VATM, more than half of the participants (56.7%) were categorized as able to perform the procedure without supervision. Only two participants remained in the Grade D category. The mean number of completed steps increased to: 19.77 ± 3.27 out of 22. The mean number of red flags decreased to: 0.97 ± 1.40

Table 4.3.3 Comparison of IV Flushing Skill Performance (N = 30)

Assessment	Mean Steps Completed	SD	Mean Difference	Paired t	p-value
Pre-test	14.43	3.75	5.33	8.13	<0.001
Post-test	19.77	3.27			

Interpretation: The mean skill score increased from 14.43 completed steps at pre-test to 19.77 completed steps at post-test. The mean improvement was **5.33 steps**. The difference between pre-test and post-test skill scores was statistically significant (**t = 8.13, p < 0.001**).

4.4 VATM Feedback

Table 4.4.1 Question-wise Distribution of Responses to VATM Feedback (N=30)

Feedback Item	Most Positive Response	n	%	Neutral/ Alternative Response	n	%	Negative Response	n	%
VATM improved my knowledge on the topic	Agree	27	90	Neutral	2	6.7	Disagree	1	3.3
VATM improved my confidence in performing related clinical skills	Agree	29	96.7	Neutral	1	3.3	Disagree	0	0
Video content was easy to understand	Easy	24	80	Neutral	6	20	Difficult	0	0
I would prefer VATM over traditional lecture-based training	Yes	18	60	Maybe	12	40	No	0	0
Would you recommend VATM to colleagues?	Yes	27	90	Maybe	3	10	No	0	0
Overall, I am satisfied with the VATM	Satisfied	26	86.7	Neutral	4	13.3	Dissatisfied	0	0

Interpretation: The feedback regarding the Video-Assisted Teaching Module was predominantly positive.

- 90.0% of participants agreed that the VATM improved their knowledge.
- 96.7% agreed that the VATM improved their confidence in performing related clinical skills.
- 80.0% found the video content easy to understand.
- 60.0% preferred VATM over traditional lecture-based training, while 40.0% responded "Maybe."
- 90.0% would recommend the VATM to their colleagues.
- 86.7% reported overall satisfaction with the VATM.

Table 4.4.2 The level of satisfaction about VATM among the participants (N=30)

Satisfaction Level	Score Range	Frequency (n)	Percentage (%)
High satisfaction	15–18	29	96.7
Moderate satisfaction	11–14	1	3.3

Low satisfaction	6–10	0	0
Total		30	100

Interpretation: Based on the predetermined scoring criteria, 29 participants (96.7%) demonstrated high satisfaction, while one participant (3.3%) demonstrated moderate satisfaction. None of the participants reported low satisfaction. Most participants agreed that the VATM improved their knowledge (90.0%) and confidence in performing related clinical skills (96.7%). Furthermore, 80.0% found the video content easy to understand, 90.0% indicated that they would recommend the VATM to colleagues, and 86.7% reported overall satisfaction with the module.



Figure 1.

4.5 Feasibility Findings of the Pilot Study

An important purpose of this pilot study was to determine whether the proposed methodology could be implemented.

The pilot demonstrated the following:

- Thirty eligible staff nurses were recruited and completed the study procedures.
- The three-day data collection procedure was practically implemented within the span of 1 month
- The 30-item Structured Knowledge Questionnaire could be administered during both pre-test and post-test assessments.
- The 22-step IV Flushing Skill Observation Checklist could be used to assess practical performance on a mannequin in the skill station.
- The Video-Assisted Teaching Module could be administered as planned.
- The feedback questionnaire was successfully completed following the intervention.
- Participants could be reassessed using the same knowledge and skill tools.

Overall, the pilot findings indicated that the proposed methodology was feasible and practical for implementation.

5. Discussion

This pilot study was conducted primarily to assess the feasibility of the proposed methodology, including participant recruitment, data collection procedures, assessment tools, intervention delivery, and post-test evaluation among staff nurses. The study also explored preliminary changes in knowledge and IV catheter flushing skills following the Video-Assisted Teaching Module (VATM).

All 30 participants completed the planned three-day study procedure, indicating that the recruitment and data collection process was feasible. The Structured Knowledge Questionnaire and 22-step IV Flushing Skill Observation Checklist were successfully used to assess knowledge and practical performance.

Knowledge scores improved from a mean pre-test score of **23.17 ± 3.69** to a mean post-test score of **27.17 ± 2.34**. The proportion of participants achieving the predetermined pass mark increased from **33.3% before the intervention to 83.3% after the intervention**, suggesting a positive preliminary change in knowledge.

Similarly, skill performance improved following the intervention. The mean number of correctly completed steps increased from **14.43 to 19.77 out of 22**. No participant achieved Grade A during the pre-test, whereas **56.7% achieved Grade A during the post-test**. The proportion of participants categorized as unable to perform the procedure decreased from **46.7% to 6.7%**.

The mean number of red flags also decreased from **3.53 to 0.97**, indicating improvement in critical aspects of IV catheter flushing performance. However, some participants continued to require supervision, suggesting that video-based learning may be strengthened further through supervised hands-on practice. Participants also reported a favourable response to the VATM, indicating good acceptability and satisfaction with the educational intervention. The integration of theoretical content and procedural demonstration within a single video may have supported both knowledge acquisition and understanding of the practical procedure.

As this was a pilot study using a small sample and one-group pre-test–post-test design, the findings should be interpreted cautiously. The observed improvements cannot establish definitive intervention effectiveness. Nevertheless, the pilot demonstrated that the proposed methodology, assessment tools, VATM delivery, and evaluation procedures were practical and suitable for implementation in a larger study.

Overall, the pilot achieved its primary purpose and provided preliminary evidence supporting the feasibility of conducting a larger study to evaluate the effectiveness of the VATM on nurses' knowledge and IV catheter flushing skills.

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