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A Comparative Analysis of Blended, Video-Based and Face-to-Face Learning Modalities for Mechanism of Labor among Nursing Students of Sikkim, India

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ABSTRACT

Background: Effective teaching strategies are crucial for enhancing clinical competencies among nursing students. This study evaluated the effectiveness of blended learning, video-based learning, and face-to-face learning on the knowledge and skill acquisition related to the mechanism of labor among undergraduate nursing students. **Methods:** A quasi-experimental study with a pre-test and post-test design was conducted at Sikkim Manipal College of Nursing. Ninety-three third-year B.Sc. nursing students were selected through complete enumeration and randomly assigned to three groups (n=31 each): Group 1 (video-based learning), Group 2 (blended learning), and Group 3 (face-to-face learning as control). Knowledge was assessed using a structured questionnaire, and skill was evaluated using a rating scale. Post-tests were administered immediately after the intervention and on the 8th and 28th days. Data were analyzed using descriptive and inferential statistics, including ANOVA, paired *t*-tests, and chi-square tests. **Results:** All three teaching methods significantly improved students' knowledge and skills ($p < 0.001$). The blended learning group showed the highest improvement in both knowledge (mean difference = 5.93) and skill scores (mean difference = 18.61), followed by face-to-face and video-based learning groups. No significant association was found between most demographic variables and post-test scores, except for age, which was significantly associated with skill performance in the blended group (p=0.020). **Conclusion:** Blended learning was the most effective teaching method for enhancing both theoretical knowledge and practical skills on the mechanism of labor among undergraduate nursing students. Integrating traditional and digital modalities offers superior educational outcomes and should be considered in nursing curricula.

Keywords: Blended Learning; Distance Learning; Learning; Literature Review; Nurse Education; Student Engagement

INTRODUCTION

In recent years, higher education has embraced learning management systems (LMS) to monitor and enhance teaching-learning processes. This shift toward technology-driven instruction has replaced traditional face-to-face methods with virtual platforms and innovative strategies, aiming to improve efficiency, resource use, and sustainability. Nursing education has also adopted these approaches, reflecting their growing relevance and impact across disciplines (Button *et al*., 2014; Castro, 2019).

Over the last 30 years, the use of the internet and information technology in higher education has become widespread. In nursing education specifically, challenges such as a shortage of qualified faculty, limited student schedules, and insufficient clinical exposure have led to concerns that undergraduate programs do not adequately prepare students for real-world clinical practice (George *et al*., 2014; Neville *et al*., 2015). Traditional face-to-face teaching alone often falls short in equipping nursing students with the

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necessary knowledge and practical skills (Button *et al*., 2014; McCutcheon *et al*., 2015; Regmi & Jones, 2020).

Technological advancements have expanded the repertoire of teaching tools available to educators. In nursing education, one of the persistent challenges is the effective teaching of practical skills. For example, within the undergraduate curriculum of Midwifery and Obstetrical Nursing, understanding and demonstrating the normal mechanism of labor is fundamental. To competently manage normal vaginal deliveries, students must grasp both the theory and application of labor mechanisms (Niu *et al*., 2023; Shorey *et al*., 2018).

India, which produces the largest number of nursing graduates globally, has seen a significant rise in private nursing colleges contributing to this output (Government of India, 2020; Indian Nursing Council, 2021). However, this expansion has been accompanied by several systemic issues: the admission of underprepared and unmotivated students, a shortage of trained faculty, limited patient exposure in clinical settings, substandard evaluation systems, and insufficient practical training during internships. These factors have adversely affected the quality of nursing education (Government of India, 2020; Indian Nursing Council, 2021).

Given these challenges, the adoption of innovative teaching strategies has become essential. The pedagogical approach adopted by instructors plays a crucial role in student learning outcomes. To address faculty shortages and time constraints, modern techniques such as video-assisted teaching have been introduced (Sharma *et al.,* 2017; Forbes *et al*., 2016). In a study, Devi *et al.,* (2019) conducted on 60 third-year B.Sc. Nursing students, comparing video-assisted instruction with traditional demonstrations in obstetrical palpation. Students in the video-assisted group achieved significantly higher post-test scores ($t = 18.35$, $p < 0.001$).

Educational videos, which combine visual and auditory stimuli, provide realistic and engaging learning experiences. Scaria *et al.* (2013) found that video instruction effectively enhanced both knowledge and skill levels among nursing students learning antenatal examination procedures. In another crossover study, David *et al*. (2020) compared knowledge and skills acquisition among dental students via video and live lectures in periodontology. The students expressed a preference for integrating video into traditional lectures rather than using it as a complete substitute (Li *et al*., 2025; Leidl *et al.,* 2020).

A study involving 80 undergraduate nursing students compared active lecture cum demonstration (ALCD) with active lecture cum video (ALCV) in the context of drug administration training. ALCV was found to be more effective (David *et al*., 2020; Abusabeib, 2025). These findings highlight the potential of blended approaches, combining traditional and modern methods, to enhance nursing education. Educators should adopt diverse, student-centered teaching strategies in clinical education, tailored to the needs and learning styles of modern learners. While traditional methods remain valuable, they should be complemented rather than replaced by technology. Especially in competency-based nursing education, a blended approach merging conventional instruction with digital tools can better support student learning and skill acquisition (Jowsey *et al*., 2020).

Blended learning merges online and face-to-face methods, enhancing flexibility, engagement, and feedback (Dangwal, 2017). Studies report improved student satisfaction and clinical skills, though effects on theoretical knowledge vary. Systematic reviews support its role in strengthening clinical competencies (Abusabeib, 2025). Aligned with National Education Policy (NEP 2020), UGC, and INC guidelines, blended learning is increasingly promoted in nursing education (Indian Nursing Council, 2021; Government of India, 2020). Teaching the mechanism of labor central to third-year Midwifery can benefit from this model, bridging gaps between theory and practice (Adinda & Mohib, 2020; Ashipala *et al*., 2024). Further research can strengthen its role in improving nursing education outcomes.

METHODOLOGY

The methodology adopted in this study follows the standard structure recommended for interventional

research in nursing education, where controlled experimental designs help establish causal relationships between teaching methods and learning outcomes (Polit & Beck, 2008; Kaveevivitchai *et al*., 2009; Abusabeib, 2025). A quantitative approach was used in this quasi-experimental study, employing a pre-test and post-test design with three parallel groups. This methodology is widely adopted in nursing education research to evaluate the effectiveness of different instructional strategies under controlled conditions (Polit & Beck, 2008). The study was conducted at Sikkim Manipal College of Nursing (SMCON). The participants were third-year B.Sc. Nursing students enrolled in the 2020–2024 batch.

The students were randomly assigned into three groups, with each group consisting of 30 students. The groups were categorized as Experimental Group 1 (Video-Assisted Learning Group), Experimental Group 2 (Blended Learning Group), and Group 3 (Control Group – Face-to-Face Learning Group). The principal investigator prepared the video recording demonstrating skills on the mechanism of labor. On Day 1, consent was obtained from all participants, followed by the administration of the pre-test to assess knowledge and pre-test observation of skills across the two experimental groups and one control group. The study was conducted in four phases.

Phase 1: Pre-Intervention Assessment: A structured knowledge questionnaire consisting of ten multiple-choice questions (MCQs) was administered to assess baseline knowledge of the mechanism of labor. The questionnaire had been validated by a panel of nursing experts and pre-tested on a sample of ten undergraduate nursing students.

Phase 2: Teaching Intervention: Students in Group 1 received only video-based demonstrations. Group 2 received blended instruction, comprising both video demonstrations and hands-on training using pelvic models and mannequins. Group 3 received only face-to-face demonstrations using conventional classroom and lab settings. All instructional sessions were carried out in the Maternal and Child Health (MCH) laboratory at SMCON, using standardized content and materials.

Phase 3: Post-Intervention Knowledge Assessment: Students were re-assessed using the same MCQ-based structured knowledge questionnaire immediately after the teaching sessions. This was done to evaluate the immediate impact of each instructional method on knowledge acquisition.

Phase 4: Skill Assessment: Itinvolved evaluating students' clinical skills in performing steps of the mechanism of labor. This was assessed by three trained evaluators who were blinded to group assignments. Each evaluator independently scored the students using a standardized rating scale, and an average score was calculated for each participant. The skill assessment tool was developed to objectively measure psychomotor competencies and was used exclusively for research purposes, not for academic grading. Post-test evaluations were conducted immediately after the intervention to avoid contamination of responses from learning sources such as videos. The tools used in the study included Tool 1, which had Section I for background variables (9 items) and Section II comprising a structured knowledge questionnaire (10 MCQs), and Tool 2, which was a rating scale developed to assess skills in performing the steps of the mechanism of labor.

Data was analyzed using IBM SPSS Statistics for Windows, version 25.0. Descriptive statistics such as frequency, percentage, mean, and standard deviation were used to describe participant characteristics and baseline scores. Within- and between-group comparisons were analyzed using ANOVA, a widely used statistical method to test differences across multiple groups (Field, 2024). A chi-square or Fisher's exact test was used to assess associations between demographic variables and outcome measures. All statistical tests were evaluated at a 0.05 level of significance, adhering to conventional thresholds for educational research (Polit & Beck, 2008).

Ethical Considerations

This study received ethical approval from the Institutional Review Committee and Institutional Ethics Committee of Sikkim Manipal Institute of Medical Sciences (SMIMS), India with reference number (SMIMS/IEC/2022-126) on 15th January, 2023.

RESULTS

Section I: Findings related to the demographic profile of undergraduate nursing students

Table 1: Findings Related to Frequency and Percentage Distribution of Demographic Variables in Face-to-Face Learning, Blended Learning and Video-Based Learning Groups (n=93)

Sl. No	Demographic Variables	Face to Face learning group (n=31)		Blended learning group (n=31)		Video based learning Group (n=31)	
		f	%	*f*	%	*f*	%
1	**Age in years**						
	17-21 years	22	71	18	58.1	21	67.7
	22-26 years	9	29	13	41.9	10	32.3
	27-31 years	0	0	0	0	0	0
	32-36 years	0	0	0	0	0	0
2	**Religion**						
	Hindu	10	32.3	5	16.1	12	38.7
	Buddhist	15	48.4	14	45.2	13	41.9
	Christian	5	16.1	10	32.3	6	19.4
	Muslim	1	3.2	2	6.5	0	0
3	**Gender**						
	Female	31	100	31	100	31	100
	Male	0	0	0	0	0	0
4	**Current residence**						
	Hostel	22	71	21	67.7	20	64.5
	Day scholar	9	29	10	32.3	11	35.5
5	**Any classes or demonstration attended on mechanism of labor**						
	Yes	0	0	7	22.6	0	0
	No	31	100	24	77.4	31	100
6.	**Any previous knowledge on mechanism of labor**						
	Yes	4	12.9	5	16.1	0	0
	No	27	87.1	26	83.9	31	100
7	**Exposure to mass media related to mechanism of labor**						
	Yes	4	12.9	6	19.4	0	0
	No	27	87.1	25	80.6	31	100
8	**Any previous experiences in taking care of women in labor**						
	Yes	8	25.8	12	38.7	5	16.1
	No	23	74.2	19	61.3	26	83.9
9	**Do you have clinical posting now**						
	Yes	31	100	31	100	31	100
	No	0	0	0	0	0	0

**p<0.05 level of significance; NS-Non-significant.*

Table 1 outlines the demographic characteristics of participants across the three groups—face-to-face (control), blended, and video-based learning. Most were aged 17–26, aligning with typical undergraduate profiles. Hinduism was the most common religion in the face-to-face (32.3%) and video (38.7%) groups, while Buddhism predominated in the blended group (45.2%). Christianity and Islam were also represented, reflecting religious diversity. All participants were female, removing gender as a study variable. Hostel residence was prevalent across all groups, indicating consistent institutional access. Exposure to labor mechanisms was limited, with only 22.6% in the blended group having attended sessions. Prior knowledge was minimal: 12.9% (face-to-face), 16.1% (blended), and 0% (video). Media exposure was rare, and practical experience with women in labor varied, highest in the Blended group (38.7%). All participants were engaged in clinical postings during the study period, ensuring a shared clinical context that may support experiential learning across all instructional formats.

Section II: Findings related to assessment of Pre-test and Post-test knowledge score (Within the Group)

Table 2: Effectiveness of Pre-test and Post-test Knowledge Score of Mechanism of Labor (Within the Group Comparison) (n=31)

Comparison	Pre-test	Post-test	Mean D	*t* value	*df*	*p* value
Face to Face learning group	1.64±1.11	6.09±1.68	4.45	15.02	30	0.001*
Blended learning group	1.58±1.05	7.51±1.50	5.93	18.28	30	0.001*
Video based learning group	1.45±0.92	5.06±1.67	3.61	10.63	30	0.001*

**p<0.05 level of significance*

Table 2 shows the effect of different teaching methods on students' knowledge of the mechanism of labor. The face-to-face group improved from a mean score of 1.64 ± 1.11 to 6.09 ± 1.68 (mean difference = 4.45, t = 15.02, p = 0.001), with a 95% confidence interval (CI) of [3.82, 5.08]. The blended learning group showed the highest gain, from 1.58 ± 1.05 to 7.51 ± 1.50 (mean difference = 5.93, t = 18.28, p = 0.001), with a 95% CI of [5.27, 6.59]. The video-based group also improved, from 1.45 ± 0.92 to 5.06 ± 1.67 (mean difference = 3.61, t = 10.63, p = 0.001), with a 95% CI of [3.04, 4.18]. All methods were effective, with blended learning producing the most significant knowledge gains.

Section III: Findings related to effectiveness of Pre-test and Post-test skill score (Between the Groups)

Table 3. Comparison of Pre- and Post-Intervention Skill Scores on Mechanism of Labor* (Between the Groups) *(n = 31 per group)

Comparison	Pre-test	Post-test	Mean D	*t* value	*df*	*p* value
Face to Face learning group	1.22±1.30	13.35±5.67	12.21	11.30	30	0.001*
Blended learning group	1.19±1.24	19.80±4.59	18.61	21.94	30	0.001*
Video based learning group	1.45±2.26	12.51±6.05	11.06	10.69	30	0.001*

**p<0.05 level of significance*

Table 3 evaluates the impact of face-to-face, blended, and video-based learning on improving practical skills related to the mechanism of labor among undergraduate nursing students. Each group comprised 31 students. The face-to-face group showed a significant increase in mean skill scores from 1.22 ± 1.30 to 13.35 ± 5.67 (mean difference = 12.21, t = 11.30, p = 0.001), with a 95% confidence interval (CI) of [10.15, 14.27]. The blended group demonstrated the highest improvement, with scores rising from 1.19 ± 1.24 to 19.80 ± 4.59 (mean difference = 18.61, t = 21.94, p = 0.001), and a 95% CI of [17.34, 19.88]. The video-based group improved from 1.45 ± 2.26 to 12.51 ± 6.05 (mean difference = 11.06, t = 10.69, p = 0.001), with a 95% CI of [9.42, 12.70]. These results indicate that all three methods were effective in enhancing practical skills, with blended learning outperforming the other methods.

Section IV: Effectiveness of Pre-test and Post-test Knowledge Score of Undergraduate Nursing Students (Between the Group) (n=31)

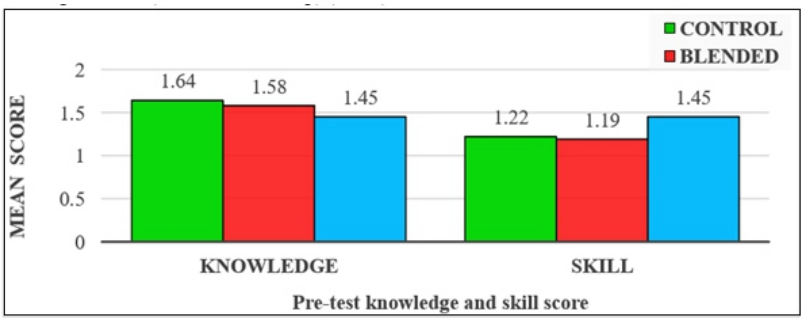

Figure 1: Comparison of Pre-test Mean Knowledge Score Among Undergraduate Nursing Students

Figure 1 shows comparable pre-test knowledge and skill scores across all three groups, indicating no significant differences and confirming baseline similarity before applying the different teaching interventions.

Table 4: Comparison of Pre-test Knowledge and Skill Score of Mechanism of Labor (Between the Group) (n=31)

Pre-test	Face to Face learning group	Blended learning group	Video based learning group	*f* value	*df*	*p* value
Knowledge	1.64±1.11	1.58±1.05	1.45±0.92	0.281	2	0.755^{NS}
Skill	1.22±1.30	1.19±1.24	0.96±1.01	0.427	2	0.654^{NS}

**P<0.05 level of significance*

Table 4 compares pre-test knowledge and skill scores among the three groups, showing no significant differences. ANOVA results confirmed similar baseline knowledge ($f = 0.281$, $p = 0.755$) and skills ($f = 0.427$; $p = 0.654$), ensuring all groups started with comparable competencies before the teaching interventions.

Section V: Findings related to effectiveness of Pre-test and Post-test Skill score of undergraduate nursing students (Between the Group) n=31

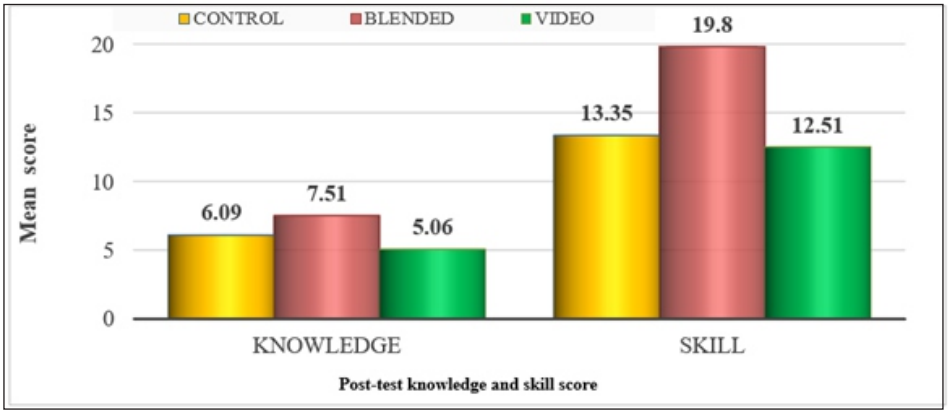

Figure 2: Comparison of Post-test Mean Skill Score among Undergraduate Nursing Students

This figure 2 compares the scores after the administration of teaching method. The Blended group scored highest in both knowledge (7.51) and skill (19.80). The Face-to-face learning (Control group) group came next, followed by the video group.

Table 5: Comparison of Post-Test Knowledge and Skill Score of Mechanism of labor (Between the group) (n=93)

Post-test	Face to Face learning group	Blended learning group	Video based learning group	*f* value	*df*	*p* value
Knowledge	6.09±1.68	7.51±1.50	5.06±1.67	17.88	2	0.001*
Skill	13.35±5.67	19.80±4.59	12.51±6.05	16.45	2	0.001*

**P<0.05 level of significance*

Table 5 presents post-test knowledge and skill scores on the mechanism of labor across three groups. The blended learning group achieved the highest scores in both knowledge and skills. Specifically, for knowledge, the blended group scored 7.51 ± 1.50, with a 95% confidence interval (CI) of [6.90, 8.12], followed by the face-to-face group with 6.09 ± 1.68 (95% CI [5.47, 6.71]) and the video-based group with 5.06 ± 1.67 (95% CI [4.38, 5.74]), with ANOVA showing significant differences ($f = 17.88$, $p = 0.001$). For skills, the blended group again outperformed the other groups with 19.80 ± 4.59, and a 95% CI of [18.19, 21.41], confirming its effectiveness ($f = 16.45$, $p = 0.001$). The face-to-face group scored 13.35 ± 5.67 for skills, with a 95% CI of [11.54, 15.16], and the video-based group scored 12.51 ± 6.05, with a 95% CI of [10.43, 14.59].

Section VI: Findings related to Association between post-test knowledge with Demographic profile

Table 6: Association between Post-Test Knowledge of Mechanism of Labor and Demographic Variables in Face-To-Face Learning Group (n=31)

Sl. No.	Demographic variables	Inadequate	Adequate	χ2 value	*df*	*P* value
1	**Age in years**					
	17-21 years	6	16	0.112	1	0.738^{NS}
	22-26 years	3	6			
	27-31 years	--	--			
	32-36 years	--	--			
2	**Religion**					
	Hindu	6	4	6.457	3	0.057^{NS}
	Buddhist	2	13			
	Christian	1	4			
	Muslim	0	1			
3	**Gender**					
	Female	9	22	NA	NA	NA
	Male	--	--			
4	**Current residence**					
	Hostel	4	18	4.124	1	0.077^{NS}
	Day scholar	5	4			
5	**Any classes or demonstration attended on mechanism of labor**					
	Yes	--	--	NA	NA	NA
	No	9	22			
6	**Any previous knowledge on mechanism of labor**					
	Yes	1	3	0.037	1	0.673^{NS}
	No	8	19			
7	**Exposure to mass media related to mechanism of labor**					
	Yes	1	3	0.037	1	0.673^{NS}
	No	8	19			
8	**Any previous experiences in taking care of women in labor**					
	Yes	1	7	1.603	1	0.379^{NS}
	No	8	15			
9	**Do you have clinical posting now**					
	Yes	9	22	NA	NA	NA
	No	--	11			

**p<0.05 level of significance; NS: Non-significant*

Table 6 shows no significant association between post-test knowledge and demographic variables in the face-to-face group ($p > 0.05$). Factors like age, religion, residence, prior knowledge, media exposure, and caregiving experience did not influence outcomes, indicating demographic variables had no effect on knowledge improvement in this group.

Table 7: Association between Post-Test Knowledge of Mechanism of Labor and Demographic Variables in Blended Learning Group (n=31)

Sl. No.	Demographic variables	Inadequate	Adequate	χ2 value	*df*	*p* value
1	**Age in years**					
	17-21 years	2	16	2.274	1	0.497^{NS}
	22-26 years	0	13			
	27-31 years	--	--			
	32-36 years	--	--			

2	**Religion**					
	Hindu	0	5	2.361	3	0.699^{NS}
	Buddhist	2	12			
	Christian	0	10			
	Muslim	0	2			
3	**Gender**					
	Female	2	29	NA	NA	NA
	Male	-	-			
4	**Current residence**					
	Hostel	1	11	0.112	1	0.632^{NS}
	Day scholar	1	18			
5	**Any classes or demonstration attended on mechanism of labor**					
	Yes	0	7	1.063	1	0.594^{NS}
	No	2	22			
6	**Any previous knowledge on mechanism of labor**					
	Yes	0	5	0.730	1	0.699^{NS}
	No	2	24			
7	**Exposure to mass media related to mechanism of labor**					
	Yes	1	5	1.028	1	0.355^{NS}
	No	1	24			
8	**Any previous experiences in taking care of women in labor**					
	Yes	0	12	2.045	1	0.510^{NS}
	No	2	17			
9	**Do you have clinical posting now**					
	Yes	2	29	NA	NA	NA
	No	--	--			

**p<0.05 level of significance; NS: Non-significant*

Table 7 shows no significant association between post-test knowledge and demographic variables in the blended group ($p > 0.05$). Age, religion, residence, prior exposure, and experience had no impact on knowledge outcomes.

Table 8: Association between Post-Test Knowledge of Mechanism of Labor and Demographic Variables in Video Based Learning Group (n=31)

Sl. No.	Demographic variables	Inadequate	Adequate	χ2 value	*df*	*p value*
1	**Age in years**					
	17-21 years	14	7	1.971	1	0.247^{NS}
	22-26 years	4	6			
	27-31 years	--	--			
	32-36 years	--	--			
2	**Religion**					
	Hindu	8	4	3.718	2	0.138^{NS}
	Buddhist	5	8			
	Christian	5	1			
	Muslim	--	--			
3	**Gender**					
	Female	18	13	NA	NA	NA
	Male	--	--			

4	**Current residence**					
	Hostel	11	9	0.219	1	0.718^{NS}
	Day scholar	7	4			
5	**Any classes or demonstration attended on mechanism of labor**					
	Yes	--	--	NA	NA	NA
	No	18	13			
6	**Any previous knowledge on mechanism of labor**					
	Yes	--	--	NA	NA	NA
	No	18	13			
7	**Exposure to mass media related to mechanism of labor**					
	Yes	--	--	NA	NA	NA
	No	18	13			
8	**Any previous experiences in taking care of women in labor**					
	Yes	3	2	0.009	1	0.659^{NS}
	No	15	11			
9	**Do you have clinical posting now**					
	Yes	18	13	NA	NA	NA
	No	--	--			

**p<0.05 level of significance; NS: Non-significant*

Table 8 shows no significant association between post-test knowledge and demographic variables in the video-based learning group ($p > 0.05$). Age, religion, residence, and prior experience showed no influence, and missing data limited analysis of gender, attendance, and media exposure, indicating demographics did not impact knowledge outcomes.

DISCUSSION

This study evaluated the effectiveness of face-to-face, blended, and video-based learning on nursing students' knowledge and skills regarding the mechanism of labor (Sáiz-Manzanares *et al.,* 2020). Demographic characteristics were similar across groups, reducing confounding variables and supporting the validity of comparisons based on pre- and post-intervention outcomes. Table 1 revealed that the participants across all three groups were largely homogeneous in age, ranging from 17 to 26 years, with the majority falling between 17 and 21 years. This aligns with the findings from recent nursing education studies (Abusabeib, 2025; Jowsey *et al*., 2020), which reported the similar age distributions among undergraduate nursing students in Indian nursing colleges. All participants were female, eliminating gender-based variability. The majority were hostel residents, suggesting institutional access and support (Leidl *et al*., 2020). The overall low levels of prior exposure to the mechanism of labor, through classes, media, or caregiving experience, ensured a level playing field for evaluating the interventions.

The within-group comparisons revealed that all three teaching approaches led to significant improvements in both knowledge and skill levels. However, the blended learning method emerged as the most effective, with the greatest increase observed in both post-test knowledge (mean difference = 5.93) and skill scores (mean difference = 18.61). This finding is consistent with existing literature suggesting that blended learning combines the strengths of traditional and digital pedagogies, offering interactive, flexible, and personalized learning experiences that promote better understanding and skill retention (Ashipala *et al*., 2024), and this also supports the findings of George *et al*. (2014), who found blended learning to be superior in enhancing theoretical understanding among nursing students due to its flexibility and interactivity. Similarly, Button *et al.* (2014) emphasized that combining digital tools with face-to-face sessions improves comprehension and motivation, especially in complex clinical topics.

Regarding skills, Table 3 showed a similar trend. The blended group again had the highest improvement (mean difference = 18.61), followed by face-to-face (12.21) and video-based learning (11.06). These findings are supported by McCutcheon *et al.* (2015) and Choi *et al.* (2021), who argued that simulation and hands-on practice integrated into blended models significantly enhance psychomotor learning. Furthermore, Niu *et al*. (2023) and Shorey *et al*. (2018) noted that the addition of digital modules allows students to revisit procedures, thereby improving performance during practical tasks (Wu *et al*., 2025). The face-to-face group showed significant improvement (knowledge difference = 4.45; skill = 12.21), supporting the value of traditional learning. However, gains were lower than in the blended group, possibly due to less flexibility. The video-based group improved too (knowledge = 3.61; skill = 11.06) but showed the least progress. This may be attributed to the passive nature of video content, which often lacks interactivity and immediate feedback essential for deeper learning and skill acquisition in complex clinical topics such as the mechanism of labor (Wang & Raman, 2025; Rajesh & Swamy, 2014). While video-based learning can be useful for reinforcing theoretical concepts, it may not suffice as a standalone method for practical skill development.

Table 4 confirmed that the pre-test knowledge and skill scores were not significantly different among the three groups ($p > 0.05$), indicating comparable baseline levels. This is consistent with standard randomization outcomes in quasi-experimental educational research (Polit & Beck, 2008), where balanced groups at the outset ensure more reliable attribution of effects to interventions rather than pre-existing differences. Between-group comparisons confirmed the superior effectiveness of blended learning. Post-test scores in both knowledge (7.51 ± 1.50) and skill (19.80 ± 4.59) were highest in this group. ANOVA tests showed significant differences across all three groups ($p = 0.001$), confirming the statistical robustness of the observed improvements. In Table 5, the blended learning group significantly outperformed the other two in both knowledge (7.51 ± 1.50) and skill (19.80 ± 4.59) scores ($p = 0.001$). These findings align with recent reviews demonstrating that blended learning promotes deeper understanding, better retention, and improved clinical competence compared to traditional instructional methods. These findings echo the results of Li *et al. (*2025), who concluded that blended learning yields better retention and deeper learning than traditional lectures. The video-based learning group, despite significant improvements, had the lowest post-test scores, likely due to the passive nature of video instruction, which lacks interactivity (Ahmed *et al*., 2025). This is supported by Li *et al*. (2025) and Balante *et al*. (2023), who highlighted that learner engagement and real-time feedback are key factors missing in video-only formats.

Tables 6 to 8 explored the association between demographic variables and post-test knowledge. No statistically significant associations were observed in any group ($p > 0.05$), suggesting that age, religion, prior exposure, and residence did not influence learning outcomes. Similar findings were reported by Kaveevivitchai *et al*. (2009), who found that learner characteristics had minimal impact on theoretical knowledge acquisition when active learning methods were applied consistently across groups. Table 10 showed that age had a significant association with post-test skill scores in the blended learning group ($p = 0.020$), whereas all other variables and groups showed no such association. This may indicate that younger students adapt more readily to technology-enhanced learning. A study by Wu *et al*. (2025) found that digital literacy significantly influences engagement and outcomes in blended learning, often correlating with age. However, the absence of such associations in the other groups indicates the robustness of the teaching methods in equalizing learning outcomes across different demographics.

Limitations

This research was conducted at one institution, and the sample size was relatively small; hence, the findings may not be generalizable. The quasi-experimental nature of the study does not imply full randomization, and the assessment of skills might have been affected by variability among raters. The brief duration of follow-up limited the assessment of long-term knowledge retention and the maintenance of skills. However, learner satisfaction and motivation, which are variables with an affective dimension, were not measured.

Nevertheless, this study has a number of strengths. A controlled quasi-experimental design with three parallel groups was employed, which permitted strong comparisons between teaching methods. Baseline similarity between the groups reduced the potential for selection bias and thereby enhanced internal validity. Standardized educational content and validated instruments contributed to the reliability of the outcome measurements. The outcome of interest skill was assessed blind to treatment status of a subject at two time points in order to reduce observer bias and to obtain a more accurate estimate of learning. The study covers a clinically relevant subject for training in midwifery and offers practical, evidence-based suggestions transferable to competency-based nursing curricula.

Recommendations

On the basis of the results of this study, blended learning could be safely applied in the teaching of labor mechanisms as part of the undergraduate nursing curriculum. Nursing educators are advised to use video-based products and live demonstrations or simulations to maximize learning retention and acquisition of skills. Facilities need to provide financial and resource support for faculty development and technology infrastructure to facilitate successful blended learning. Larger, multi-center, longer follow-up studies including affective learning outcomes are suggested for future research to validate and potentially extend the findings of the present study on blended learning in nursing education.

CONCLUSION

This study highlights the superior effectiveness of blended learning over face-to-face and video-based methods in enhancing nursing students' knowledge and skills on the mechanism of labor. By combining digital resources with practical experience, blended learning promotes engagement, flexibility, and retention, making it ideal for competency-based education. Despite significant gains across all groups, blended learning consistently led to the highest outcomes. Future studies should include larger, multi-centric samples and longer follow-ups and explore advanced technologies like virtual reality and AI to further strengthen nursing education.

Conflict of Interest

The authors declare that they have no competing interests.

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