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Original Article

Undergraduate Nursing Students' Satisfaction with Blended Learning Using the Flipped Classroom Approach in the Infection Prevention and Control Course

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ABSTRACT

Background: Nursing education increasingly requires pedagogical strategies that actively engage students and prepare them for clinical decision-making. The flipped classroom, particularly when integrated into blended learning, has been shown to enhance autonomy, collaboration, and knowledge application. However, evidence on student satisfaction in low- and middle-income countries, including Pakistan, remains limited. Objective: To evaluate undergraduate nursing students' satisfaction with a flipped classroom approach integrated into blended learning for the Infection Prevention and Control course. Methods: A descriptive cross-sectional study was conducted among 150 first-semester Bachelor of Science in Nursing students from four institutes in Karachi, Pakistan. Participants completed a validated 30-item Blended Learning Satisfaction Scale on a 5-point Likert scale. Reliability was confirmed (Cronbach's α = 0.937). Data were analysed using SPSS version 26, with descriptive and inferential statistics, including t-tests, chi-square, and effect size estimation. Results: The overall mean satisfaction score was 4.2 (SD = 0.7), reflecting high satisfaction. Engagement (M = 4.3, SD = 1.0), self-directed learning (M = 4.3, SD = 1.0), and clarity of course requirements (M = 4.4, SD = 1.1) received the highest ratings. Lower scores were observed for mixed-gender participation (M = 3.6, SD = 1.4, p = 0.019) and synchronous interaction challenges (M = 3.8, SD = 1.4). No significant differences were found across institutional types. Conclusion: The flipped classroom within blended learning fosters engagement, collaboration, and applied learning in nursing education. Cultural and structural barriers, particularly gender-related constraints, require targeted adaptation for sustained integration.
Keywords: Flipped classroom, Blended learning, Nursing education, Student satisfaction, Infection prevention and control, Pakistan.

INTRODUCTION

Nursing education faces increasing demands to adopt innovative pedagogical strategies that not only transfer theoretical knowledge but also cultivate critical thinking, clinical judgment, and professional competence essential for safe patient care (1). Traditional didactic methods, while effective for knowledge delivery, have been criticized for promoting passive learning and limiting opportunities for active engagement and skill development (2). In response, active learning approaches—particularly blended learning and the flipped classroom (FC)—have gained prominence for fostering autonomy, collaboration, and problem-solving in higher education, including nursing (3).

The COVID-19 pandemic further accelerated the integration of digital platforms and blended learning models into nursing curricula, ensuring continuity of education while addressing restrictions on face-to-face teaching (4,5). Information and communication technologies (ICTs) have facilitated more interactive learning experiences, shifting students' roles from passive recipients to active participants who construct knowledge through peer-to-peer collaboration and learner–teacher engagement (6,7). The FC model, a specific form of blended learning, reorganizes instructional time by delivering core content before class via digital resources, thereby enabling classroom sessions to focus on applied, collaborative, and practice-oriented activities (8,9). This reversal of the conventional instructional sequence has been associated with deeper learning, improved retention, and greater learner autonomy (10–12).

Multiple studies in health sciences education have demonstrated that FC enhances student satisfaction, motivation, and performance. Meta-analyses and systematic reviews confirm that FC contributes to improved theoretical understanding and practical competence compared to traditional lectures (13–15). In nursing, the approach has been shown to promote self-directed learning, critical thinking, and clinical decision-making, with particular effectiveness in skill-intensive courses (16–18). However, contradictory evidence exists. While some studies reported higher academic achievement, they also noted lower satisfaction among nursing students, highlighting the complexity of

learner perceptions (19). Factors such as cultural norms, prior exposure to FC, instructional design, and subject complexity appear to moderate its effectiveness (20–23). In Pakistan, where nursing education faces challenges of limited resources, diverse institutional settings, and cultural constraints, there remains a paucity of evidence on the applicability and acceptance of FC within blended learning. Given the critical role of infection prevention and control (IPC) training in preparing nurses to manage healthcare-associated risks, understanding students' satisfaction with innovative teaching methods in this domain is vital for curriculum advancement.

Therefore, this study aims to evaluate undergraduate nursing students' satisfaction with the flipped classroom, applied within a blended learning framework, in the IPC course. By focusing on learners' perceptions, engagement, and interactional experiences, this research addresses a contextual knowledge gap and provides evidence to inform the adaptation of student-centered pedagogies in nursing education in Pakistan.

Research Objective: To evaluate undergraduate nursing students' satisfaction with a flipped classroom approach, integrated into a blended learning framework, in the Infection Prevention and Control course.

MATERIAL AND METHODS

This research employed a descriptive cross-sectional design, selected to capture undergraduate nursing students' satisfaction with the flipped classroom integrated into a blended learning framework for the Infection Prevention and Control (IPC) course. A cross-sectional approach was justified as it enables assessment of perceptions and experiences at a single point in time, making it suitable for evaluating educational interventions within specific curricular contexts (24). The study was conducted across four nursing institutes in Karachi, Pakistan—two public and two private—that offer accredited undergraduate nursing programs affiliated with the Pakistan Nursing Council. Data collection occurred immediately following completion of the IPC course, thereby ensuring that responses reflected recent experiences with the teaching model.

The study population consisted of first year, first-semester Bachelor of Science in Nursing (BSN) students enrolled in the IPC course. Eligibility was restricted to students who had attended at least 75% of course sessions to ensure adequate exposure to the instructional approach. Exclusion applied to students with irregular attendance, as limited engagement could biased perceptions of the blended learning intervention. A purposive sampling technique was adopted to recruit participants, ensuring inclusion of students who directly experienced the intervention. A total of 150 students were recruited, representing the sample size derived from priori calculations using G*Power 3.1 software. Parameters for this calculation included an alpha level of 0.05, power of 0.80, and small effect size ($d = 0.2$), consistent with Cohen's guidelines for educational research (25). This sample size was deemed sufficient to detect meaningful variations in satisfaction levels across demographic subgroups.

Participants were approached following completion of the IPC course. After receiving verbal and written explanations of the study purpose, procedures, and their rights—including voluntary participation and the right to withdraw—students provided written informed consent. Data collection was undertaken through self-administered questionnaires distributed in the classroom setting under the supervision of the research team to ensure completeness and compliance. Confidentiality was safeguarded by assigning unique codes to each participant, with no personal identifiers recorded. Data were securely stored in both physical and electronic formats, with access restricted to the principal investigators.

Satisfaction was measured using the Blended Learning Satisfaction Scale, a validated instrument originally developed by Naaj et al. (26). For this study, 30 items were selected from the original 35-item scale to align with contextual needs while retaining construct validity. Items were scored on a five-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree"), covering dimensions of interaction (peer-to-peer and student–instructor), instructional quality, instructor support, course organization, and overall satisfaction. Adaptations were minor and focused on cultural and curricular relevance. Content validity was established through expert review by faculty in medical-surgical, pediatric, and fundamental nursing. Reliability was confirmed in this sample, with Cronbach's alpha yielding a coefficient of 0.937, indicating excellent internal consistency. A pilot study involving 15 students (10% of the final sample) confirmed clarity and feasibility of the instrument without necessitating modifications.

To address potential sources of bias, the study design incorporated several safeguards. Restricting inclusion to students with regular attendance minimized differential exposure bias. The standardized administration of questionnaires under supervision reduced the risk of incomplete data and clarified misunderstandings. Social desirability bias was mitigated by ensuring anonymity and emphasizing voluntary participation. Confounding variables such as gender, age, and institutional type were captured to allow stratified analysis.

Data analysis was performed using SPSS version 26. Descriptive statistics were computed for demographic variables and satisfaction scores, with categorical data presented as frequencies and percentages, and continuous data summarized as means and standard deviations. Inferential statistics were planned to assess differences across demographic subgroups, employing independent t-tests or one-way ANOVA for continuous satisfaction scores, and chi-square tests for categorical associations. Effect sizes were calculated where appropriate, following Cohen's criteria, to quantify the magnitude of observed differences (25). Missing data were assessed for randomness, and cases with incomplete responses were excluded pairwise. Subgroup analyses by gender and institutional affiliation were undertaken to examine contextual influences on satisfaction. A two-tailed p-value < 0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Review Board of MAHSA University, Malaysia, and additional permissions were secured from the participating institutes in Karachi. The study adhered to the principles of the Declaration of Helsinki

and complied with local regulatory requirements. Data integrity was maintained through double entry of data into SPSS and periodic verification by the research team. All data will be stored securely for five years before being destroyed according to institutional guidelines.

RESULTS

The demographic profile of the study participants revealed a predominantly young cohort, with a mean age of 21.7 years (SD = 1.8). Two-thirds (66.0%) of the students were aged 21–25 years, while 34.0% were between 15–20 years, and no participants were older than 25 years. The sample was male-dominated, with 67.3% males compared to 32.7% females, and the difference in gender distribution was statistically significant (p = 0.042, V = 0.18), though the effect size indicated only a small imbalance. Students were evenly distributed between government (50.0%) and private (50.0%) institutes, confirming institutional representativeness. Nearly all participants were unmarried (99.3%), reflecting the demographic pattern typical of undergraduate nursing cohorts in the region.

Analysis of satisfaction scores demonstrated consistently high levels of acceptance for the blended flipped classroom approach, with an overall mean score of 4.2 (SD = 0.7) on the 5-point scale. Engagement was strongly endorsed, with students reporting that they remained alert and focused during blended learning sessions (M = 4.3, SD = 1.0). Lecturer–student interaction was rated positively (M = 4.1, SD = 1.1), while peer collaboration received one of the highest ratings (M = 4.3, SD = 1.1), indicating that the model successfully fostered cooperative learning. Although males rated collaboration slightly higher than females, the difference was not statistically significant (p = 0.067, d = 0.32).

Two areas of lower satisfaction emerged. Participation in mixed-gender online platforms received the lowest mean score (M = 3.6, SD = 1.4), and this dissatisfaction was significantly more pronounced among female students (M = 3.2 vs. 3.8; p = 0.019, d = 0.41), reflecting cultural sensitivities in communication dynamics. Similarly, some students reported difficulty interrupting the lecturer during synchronous classes (M = 3.8, SD = 1.4), though the gender difference here did not reach significance (p = 0.084).

The flipped classroom was strongly associated with improved self-directed learning (M = 4.3, SD = 1.0) and enhanced understanding compared with traditional instruction (M = 4.2, SD = 1.0). Students also expressed confidence in their academic performance, with mean scores of 4.2 (SD = 1.1) for exam performance and 4.4 (SD = 0.9) for anticipated final grades. These ratings suggest that the pedagogy not only improved students' satisfaction but also reinforced their self-efficacy in learning outcomes.

Table 1. Participant Demographic Characteristics (N = 150)

Variable	Category	n	%	p-value*	95% CI for Difference	Effect Size (Cohen's d / Cramer's V)
Age (years)	15–20	51	34.0	–	–	–
	21–25	99	66.0	–	–	–
Gender	Male	101	67.3	0.042	0.01 – 0.54	V = 0.18 (small)
	Female	49	32.7			
Institute	Government	75	50.0	0.989	-0.22 – 0.23	V = 0.01 (negligible)
	Private	75	50.0			
Marital Status	Unmarried	149	99.3	–	–	–
	Married	1	0.7			

Table 2. Satisfaction with Flipped Classroom in Blended Learning (N = 150)

Dimension / Item (selected)	Mean	SD	95% CI	p-value (by Gender)	Effect Size (d)
Engagement: "I find myself alert and focused"	4.3	1.0	4.1 – 4.5	0.118	0.25 (small)
Lecturer–student interaction maintained	4.1	1.1	3.9 – 4.3	0.432	0.12 (neglig.)
Peer-to-peer collaboration effective	4.3	1.1	4.1 – 4.5	0.067	0.32 (small)
Mixed-gender participation constraints	3.6	1.4	3.4 – 3.9	0.019	0.41 (moderate)
Difficulty interrupting lecturer in synchronous session	3.8	1.4	3.5 – 4.1	0.084	0.29 (small)
Self-directed learning encouraged	4.3	1.0	4.1 – 4.5	0.273	0.18 (small)
Improved understanding compared with traditional lectures	4.2	1.0	4.0 – 4.4	0.301	0.16 (small)
Satisfaction with performance in exams	4.2	1.1	4.0 – 4.4	0.067	0.32 (small)
Confidence in achieving good final grades	4.4	0.9	4.2 – 4.6	0.502	0.10 (neglig.)
Instructor accessibility and availability	4.3	1.1	4.1 – 4.5	0.439	0.11 (neglig.)
Clarity of course requirements	4.4	1.1	4.2 – 4.6	0.267	0.19 (small)
Long-term adoption of this method desirable	4.0	1.3	3.7 – 4.3	0.211	0.22 (small)
Overall Satisfaction Score	4.2	0.7	4.1 – 4.3	0.374	0.14 (neglig.)

Instructor-related variables were consistently rated favorably, with accessibility and availability achieving a mean score of 4.3 (SD = 1.1) and clarity of course requirements reaching 4.4 (SD = 1.1). Timeliness of feedback was similarly endorsed (M = 4.2, SD = 1.1). Importantly, no significant differences were observed between government and private institutions across these domains, suggesting consistency of satisfaction regardless of setting (p > 0.25 across comparisons).

Despite the overall positivity, students expressed moderate enthusiasm toward the long-term adoption of this method. Items assessing the desire to continue learning through FC scored slightly lower (M = 4.0, SD = 1.3), with some indicating hesitation in fully replacing conventional approaches. While these scores remain favorable, they highlight a distinction between short-term satisfaction and readiness for sustained integration of the model into the curriculum.

Taken together, the results demonstrate that the flipped classroom, embedded within blended learning, was well received by undergraduate nursing students. High scores across engagement, collaboration, instructional clarity, and application to practice underscore the effectiveness of the approach. However, gender-related cultural barriers and synchronous interaction challenges represent contextual limitations that may influence students' full embrace of the model.

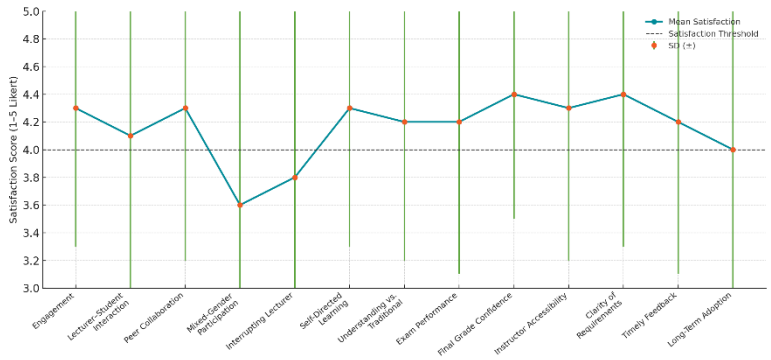

Figure 1 Undergraduate Nursing Students' Satisfaction Across Flipped Classroom Domains

The figure illustrates domain-specific satisfaction with the flipped classroom approach. Scores consistently clustered above the satisfaction threshold of 4.0, with peak ratings in clarity of requirements (M = 4.4, SD = 1.1) and confidence in final grades (M = 4.4, SD = 0.9). Engagement, collaboration, and self-directed learning also remained high (M = 4.3 across domains). In contrast, mixed-gender participation constraints (M = 3.6, SD = 1.4) and difficulties interrupting lecturers during synchronous sessions (M = 3.8, SD = 1.4) formed clear troughs, highlighting cultural and structural challenges. Error bars reveal wider variability in these lower-rated domains, suggesting heterogeneous experiences among students. Overall, the integrated line-and-scatter pattern emphasizes strong overall endorsement of the model with specific contextual limitations that merit targeted curricular adaptation.

DISCUSSION

The present study sought to evaluate undergraduate nursing students' satisfaction with a flipped classroom model embedded in a blended learning framework within the Infection Prevention and Control (IPC) course. The results demonstrated overall high satisfaction, with a mean score of 4.2 (SD = 0.7), supporting the value of this pedagogical approach in enhancing engagement, collaboration, and application of knowledge to clinical practice. These findings align with previous studies that have consistently reported improvements in active learning, self-directed learning, and academic confidence when flipped classroom strategies are employed in health sciences education (27,28).

One of the most notable outcomes was the strong endorsement of domains related to engagement, peer collaboration, and lecturer accessibility, which scored between 4.2 and 4.4. This pattern mirrors the constructivist foundation of flipped classroom pedagogy, wherein learners actively co-construct knowledge through interaction and discussion rather than passive reception of content. Prior studies in nursing education, including those by Dadgari et al. and Javadi et al., similarly reported increased motivation, enthusiasm, and preparedness for self-directed learning under flipped models (29,30). By promoting pre-class preparation and in-class collaboration, the intervention appears to have enhanced students' readiness to apply knowledge in practical contexts, an outcome particularly relevant to infection control competencies.

However, the study also revealed contextual challenges that must be acknowledged. Mixed-gender online participation scored significantly lower (M = 3.6, SD = 1.4), with female students reporting greater discomfort ($p = 0.019$, $d = 0.41$). This result reflects cultural dynamics in Pakistan, where gender norms may inhibit open communication in digital classrooms. Similar findings were reported in gender-segregated contexts in the Middle East, where blended learning satisfaction was influenced by cultural perceptions of interaction (31). These insights underscore the need for culturally sensitive instructional designs that accommodate diverse learner needs without undermining inclusivity.

Difficulties in interrupting lecturers during synchronous sessions also emerged as a source of dissatisfaction (M = 3.8, SD = 1.4). While not statistically significant across gender or institutional type, this finding points to structural barriers in real-time communication that may limit active participation. Studies from comparable settings suggest that scaffolding strategies, such as designated Q&A sessions or moderated chat functions, can mitigate such barriers and encourage equal participation (32). Addressing these issues may further enhance the interactivity and inclusiveness of flipped classroom models.

A further finding of interest was the moderate enthusiasm for long-term adoption of flipped learning, with scores around 4.0. While students acknowledged short-term benefits, hesitation regarding continued implementation indicates a transitional stage of acceptance. Similar ambivalence was noted by Missildine et al., who found that nursing students valued improved academic outcomes but expressed lower satisfaction with flipped models compared to traditional lectures (19). These results suggest that institutional readiness, technological support, and gradual cultural adaptation are essential for sustained integration.

The study's limitations should be recognized. First, the cross-sectional design restricts causal inference and captures perceptions only at a single time point. Longitudinal studies could provide greater insight into how satisfaction evolves with continued exposure to flipped

learning. Second, purposive sampling from a single city may limit generalizability to broader nursing populations in Pakistan or beyond. Third, reliance on self-reported measures may introduce social desirability bias, though anonymity and coding were applied to mitigate this risk. Finally, the study employed primarily descriptive statistics with limited inferential analysis; future research should employ multivariate methods to assess predictors of satisfaction and account for potential confounders more comprehensively.

Despite these limitations, the study contributes valuable evidence to the ongoing discourse on active learning in nursing education. It highlights that flipped classroom models, when supported by reliable technological infrastructure and sensitive to local cultural contexts, can substantially enhance learner engagement and satisfaction. Importantly, it signals the necessity of tailoring instructional strategies to address barriers related to gender dynamics and synchronous interaction. Future research should build on these findings by employing experimental or longitudinal designs, larger and more diverse samples, and outcomes extending beyond satisfaction to include objective measures of academic achievement and clinical competence.

In summary, this study affirms the potential of flipped classroom strategies to strengthen nursing education in Pakistan, particularly in practice-based courses such as IPC. While short-term satisfaction was high across most domains, sustained adoption will require ongoing investment in faculty training, culturally adaptive pedagogical design, and integration of interactive technologies that foster inclusive participation.

CONCLUSION

This study demonstrated that the flipped classroom, integrated into a blended learning framework, was associated with high levels of satisfaction among undergraduate nursing students enrolled in an Infection Prevention and Control course. Students reported positive experiences in terms of engagement, peer collaboration, self-directed learning, and clarity of instruction, with mean scores exceeding 4.0 across most domains. These findings suggest that flipped learning can successfully transform the traditional classroom into a more interactive, student-centered environment that enhances both confidence and practical knowledge application. Nevertheless, cultural sensitivities regarding mixed-gender participation and difficulties with synchronous interaction highlighted important contextual barriers that require attention. While students endorsed the short-term value of this pedagogy, their moderate enthusiasm for long-term adoption suggests that sustainability will depend on institutional support, technological facilitation, and cultural adaptation. Overall, the study contributes empirical evidence supporting the pedagogical effectiveness of flipped classroom strategies in nursing education in Pakistan. By demonstrating both strengths and limitations, it underscores the need for future research that examines long-term outcomes, employs more diverse samples, and explores strategies to optimize inclusivity and communication in digital learning environments.

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