https://doi.org/10.37723/jumdc.v17i1.1103

J. Univ. Med. Dent. Coll.2026;Vol.17(1): 1205-1209
ISSN (Print) 2221-7827, ISSN (Online) 2310-5542
https://www.jumdc.com

Open Access

Original Article

Exploring medical students' perceptions of the flipped classroom model: A cross- sectional study

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ABSTRACT

BACKGROUND & OBJECTIVE: The flipped classroom model in medical education is gaining more attention as an innovative way to enhance engagement and active learning. Therefore, this study explores medical students' perceptions of the flipped classroom model and investigates whether preferences change across different years of study at a medical college in Karachi, Pakistan. To explore medical students' perceptions of the flipped classroom model in a medical college in Karachi, Pakistan.

METHODOLOGY: This cross-sectional study, conducted at Bahria University Health Sciences Campus, Karachi, from September 2023 to March 2024, included 298 randomly sampled students. Structured questionnaires were used to collect data, and SPSS 23 was used for analysis. Associations ($p < 0.05$) were evaluated using the Fisher test. All participants provided their informed permission, and ethical approval was obtained.

RESULTS: Most students rated their knowledge of the flipped classroom model as average to limited, with significant variations across years of study ($p = 0.001$). Preferences varied, with 38% of favoring a blended teaching approach, while a traditional lecture-style was more popular among year students. Screen-based educational activities were frequently engaged in by 43.9% of students, and online resources were the preferred choice for tackling challenging topics, especially among (76%).

CONCLUSION: The flipped classroom is perceived differently by medical students over time, according to research, which highlights the need for flexible teaching strategies that combine traditional and flipped methods to improve academic performance and student engagement.

KEYWORDS: Educational Model, Medical Students, Active Learning, Flipped.

INTRODUCTION

The field of medical education is constantly shifting as new educational approaches take into account the diverse demands and preferences of teachers and students. One of the updated teaching approaches is the flipped classroom model, which has become increasingly popular over the last decade [1]. The flipped-classroom approach redefines traditional educational delivery by moving activities typical of homework into the instructional classroom while bringing instructional content, often delivered online, into the classroom [2]. The primary purpose of implementing a flipped classroom method is to engage students maximally, increase academic excellence, and facilitate active learning for students through flipping the traditionally held classes [3].

It is a new model of teaching in which the traditional classroom model is reversed. That is, students receive the instructional materials even before attending classes and work on them independently. The sessions in the classroom are not passive because the students are involved in discussion, problem-solving, and other practical activities. A teacher is a facilitator who provides individualised support and feedback to the student as he or she probes the subject matter [4,5].

In effect, the flipped classroom model can be used as an alternative to maximise classroom hours as it focuses more on tasks that promote deep learning and critical thinking to the greatest extent while aiding motivation among students and equipping them with better readiness towards academic work [6]. On-site acquisition of general information reduces

How to cite this: *Kumar K, Mehmood K, Rehman S, Ali H, Moazzam H, Fahim MF. Exploring medical students' perceptions of the flipped classroom model: A cross- sectional study . Journal of University Medical & Dental College. 2026;17(1):1205-1209.*

the time required to engage peers and the teacher through meaningful face-to-face interactions during classwork[7]. In educational settings, flipping has been an effective approach in health professions education to encourage active learning, thereby improving the overall student learning experience [8].

The flipped classroom model gives students the flexibility to learn by using self-paced instructional videos. They can access these films anytime, anywhere; thus, they can control how they speed up, rewind, pause, or replay video lectures. This kind of self-directed learning has been proven effective because it reduces the mental load of students, and thus makes learning more efficient and accessible[9]. It is also in this manner that the customized learning strategy of the flipped classroom will be found to be especially helpful in teaching students who have varying skills. Different students, with varying levels of prior knowledge, can receive individualised training and be guided according to their requirements by accessing educational information outside the classroom. Hence, this method maximizes the control over the cognition load, thus making this learning process successful[10,11].

The old traditional learning environment has some drawbacks. It is instructor-dependent and time and geography-bound, which can hinder the achievement of unbiased teaching and the individual talents of the learners [10]. E-learning provides the flexibility of time and geography that allows personalization. Teachers around the world have considered the differences in their students' abilities apart from their methods. Teachers have adopted a novel method of teaching that tries to deliver more flexible lessons to meet the demands of the slow learners or those who have missed classes and find it hard to catch up. This makes the learning students adapt while trying to create a more customized and friendly learning environment[12].

Flipped classroom models have demonstrated the potential to empower students in customizing their learning experience, thus reducing cognitive load based on their individual understanding levels. This tailoring to expertise allows high-achieving students to skip parts of the material they already grasp, while providing lower-achieving students the opportunity to review content they find challenging, promoting self-pacing. Even in the demanding context of graduate medical education, where learners have limited time for preparation, the perception of flipped classroom learning remains positive. The study showed that residents felt they became better teachers after experiencing a flipped classroom approach, and studies reported increased confidence among residents in performing ultrasound [12,13].

This cross-sectional study aims to investigate medical students' perceptions of the flipped classroom model, focusing on its impact on their learning, engagement, and overall educational experience. By examining a range of variables, including students' satisfaction, perceived learning outcomes, and preferences for traditional versus flipped classroom settings, the study seeks to provide a comprehensive overview of the model's reception among future healthcare professionals. The findings of this research could inform future educational strategies and contribute to the ongoing discussions on how best to prepare medical students for their future roles in the healthcare sector.

METHODOLOGY

This study explores medical students' perceptions of the flipped classroom model ERC BUHS-IRB 001/23, Bahria University, has given formal ethical approval to this research proposal, strictly following the guidelines of ethical codes. This study was a cross-sectional investigation conducted over six months, from September 2023 to March 2024, at the Health Sciences of Bahria University in Karachi, Pakistan. Informed consent was also taken before enrollment from all the participants in the studies, and the English version of the consent form was used to clearly elicit the understanding of each participant.

This sample study targeted 298 students in the MBBS program who were enrolled in Bahria University Health Sciences, of which 1,320 students have been estimated at a confidence level of 95% while using the Epi Info version 3 to make the calculations for sample sizes. The sample will be randomized, ensuring that all students have an equal opportunity to represent themselves and reducing selection bias while increasing the sample representation.

Inclusion criteria encompassed students currently enrolled in the MBBS program across all academic years at the Bahria University of Health Sciences. This strategy ensured that the medical education program participants represented a diverse variety of perspectives and experiences. To maintain the desired medical student population, students from non-medical professions, those not enrolled in the specified MBBS program, and students from other universities were excluded.

Data collection was conducted using structured questionnaires distributed to the selected participants. The purpose of the questionnaires was to gather information on students' opinions of the flipped classroom model, including their experiences, preferences, and levels of engagement. The survey was created in English and included both multiple-choice and open-ended questions to collect comprehensive data on all facets of the flipped classroom approach.

SPSS version 23.0 was then used to enter and evaluate the gathered data. Categorical variables were summarized using descriptive statistics, such as frequencies and percentages, and relationships between independent and dependent variables were investigated using the Chi-Square and Fisher Exact tests. A statistically significant link between variables was defined as a p-value of less than 0.05.

RESULTS

The study included 298 participants, most of whom (67.1%) were between the ages of 21 and 24. The majority of participants (65.4%) were female, while fourth-year students (40.6%) had the highest representation by study year, followed by first-year students (16.4%) and third-year students (16.1%) as shown in Table-I.

Table-I: Demographic data of MBBS students of Bahria University Health Sciences.

Demographics	Category	n(%) n=29
Age	16-20	89 (29.9)
	21-24	200 (67.1)
Gender	25-28	9 (3.0)
	Female	195 (65.4)
Year of Study	Male	103 (34.6)
	1st year	49 (16.4)
	2nd year	41 (13.8)
	3rd year	48 (16.1)
	4th year	121 (40.6)
	5th year or higher	39 (13.1)

A statistically significant difference in the distribution of educational model preferences across academic years was observed (p = 0.004). Among second-year students, 48.8% preferred traditional lectures, while 53.7% expressed greater interest in blended instruction. In contrast, blended teaching emerged as the predominant choice among fourth-year (62.2%) and fifth-year students (59.0%), with only 20.5% of the latter favouring traditional methods, as shown in Table -II.

There were significant differences in the frequency of screen-based instructional activities between year groups (p = 0.001). Second-year students were the most likely to participate daily (43.9%), while fourth-year students were the most likely to engage occasionally (35.5%). Across all years, fewer students participated in these activities, with fewer than 10% participating infrequently or not at all, as shown in Table-III.

Table-II: Preferences for educational models by year of study.

Preference	1st Year (n=49)	2nd Year (n=41)	3rd Year (n=48)	4th Year (n=121)	5th Year (n=39)	P-value
No strong preference	8 (16.3)	6 (14.6)	12 (25.0)	27 (22.3)	8 (21.6)	0.004
Prefer blended approach	26 (53.1)	15(36.6)	12 (25.0)	65 (53.7)	23 (59.0)	
Prefer traditional lecture-style	15 (30.6)	20 (48.8)	24 (50.0)	29 (24.0)	8 (20.5)	

P-values calculated using Chi-Square test for categorical variables to assess differences across year groups.

Table-III: Engagement in screen-based educational activities by year of study.

Frequency	1st Year (n=49)	2nd Year (n=41)	3rd Year (n=48)	4th Year (n=121)	5th Year (n=39)	P-value
Daily	17 (34.7)	18 (43.9)	9 (18.8)	28 (23.1)	9 (23.1)	0.001*
Occasionally	17 (34.7)	11 (26.8)	15 (31.3)	43 (35.5)	13 (28.2)	
Once or twice a week	10 (20.4)	6 (14.6)	12 (25.0)	26 (21.5)	11 (28.2)	
Rarely or never	0 (0.0)	1 (2.4)	2 (4.2)	5 (4.1)	1 (2.6)	
Several times a week	5 (10.2)	5 (12.2)	10 (20.8)	19 (15.7)	5 (12.8)	

Regarding resources consulted for challenging topics, the majority of students across all years preferred online resources, with 76% of fourth-year students and 71.8% of fifth-year students opting for them. First-year students were more likely to use traditional class lecture materials (18.4%), and second-year students were more inclined to seek help from teachers or classmates (19.5%).

DISCUSSION

In medical education, the flipped classroom paradigm has attracted greater attention because of its ability to promote active learning and enhance memory retention. The educational paradigm was preferred differently in each survey year. Overall, 53.7% of fourth-year students preferred a blended approach, indicating the increasing acceptance of combining traditional and flipped techniques in medical education. It's interesting to note that a sizable percentage of first-year (53.1%) and fifth-year (59%) students also strongly preferred the blended approach, indicating that they value having access to a range of instructional techniques as their education advances.

The more junior years of study preferred the traditional lecture-style teaching. For instance, 48.8% of the second-year students preferred the traditional lecture method. This may be due to the fact that such students had less exposure to the advanced self-directed learning methods, since students of the first two years might rely more on structured instruction from instructors. On the other hand, the increasing trend of using the flipped or blended model for higher years shows that as medical education advances, students accept more active learning that encourages critical thinking and self-directedness. These findings are consistent with previous studies, which report that younger students often require more time to adapt to self-directed formats, suggesting the necessity of gradually integrating flipped methodologies [11,12].

The study highlighted significant differences in engagement levels with screen-based educational activities across various years of study. The highest engagement rate is observed in the students in their second year, with a 43.9% daily engagement rate. Thus, these students depend entirely on digital tools to support their academic lives. It may be inferred that these students are in an adaptation phase

regarding medical education, during which they will require numerous web resources to support their understanding of the complex subject. Instead, the highest frequency of occasional engagement was observed among fourth-year students at 35.5%, suggesting greater selectivity and perhaps a strategic use of screen-based learning as they reach a more advanced stage of learning. This could also be due to the increased burden of academics, practical, and clinical rotations in their education, which necessitates a more purposeful use of online learning materials. These patterns imply that students grow more disciplined and intentional in their screen-based study habits as they progress through their schooling and begin to take on responsibilities with digital tools.

The p-value is 0.001, indicating significant differences in screen time engagement across the different year groups. This may be related to the different demands and structures of curricula at different stages of medical training. Perhaps the increase in demand for screen-based learning is related to the greater the of online lectures and e-learning support, complementing the flipped classroom model [13]. In this regard, the results of Maria et al. resonate well, of they find it suitable to highlight the significance of digital resources in supporting the flipped model by providing better access to educational content outside the traditional classroom setting [12].

Regarding sensitive topics, 76% of fourth-year students preferred online resources, underscoring the growing role of digital technology in modern medical education. Such a trend reflects the tendencies towards self-directed learning, which is observed in the growth of independent search for the information on the part of advanced students. The preference for online resources may be the fastest, most convenient, and in some cases, the most comprehensive information source that can provide much more information in order to access current clinical information online, multimedia material and facilitate better understanding of the more complex topics.

First-year students, on the other hand, demonstrated a stronger propensity to rely on conventional lecture materials, indicating that they may still feel more at ease with organized, teacher-led instruction. This dependence on conventional materials can result from their early medical school years, when they are still getting used to the requirements of the program and may feel more at ease with tried-and-true teaching strategies. Students shift to more autonomous, technology-based learning techniques as they advance in their education, showing an increasing level of comfort using digital resources and customizing their education to meet their own requirements. This change is in keeping with the broader movement to incorporate digital literacy into medical school, preparing students for a healthcare setting where technology and online information access are increasingly prevalent [14-16].

Our findings underscore the need of tailor educational techniques to medical students' shifting requirements and preferences. Higher-year students were found to prefer the flipped or hybrid classroom approach, likely due to the greater importance of individual study and problem-solving skills in postgraduate medical education. These findings are consistent with research demonstrating that the flipped classroom style fosters enhanced comprehension, critical thinking, and active learning [17,18].

The wide range of preferences, expertise, and engagement with screen-based activities suggests that a one-size-fits-all approach may be ineffective in medical education. Instead, implementing a flexible, student-centred curriculum that integrates features of both traditional and flipped classroom models could improve learning outcomes and better prepare students for employment in healthcare [19,20].

The fact that this study was conducted at a single institution may limit the generalizability of its findings to other medical schools with different curricular structures, teaching methodologies, and institutional cultures. Variations in faculty development programs, exposure to technology, resource availability, and institutional priorities across medical schools could influence faculty awareness, perceptions, and adoption of AI in education. Consequently, the results should be interpreted with caution when extrapolating to broader educational contexts, and future multicenter studies involving diverse institutions would provide a more representative understanding. Furthermore, the cross-sectional design only provides a snapshot of students' perspectives, which may change as they become more comfortable with the flipped classroom structure. Longitudinal approaches should be used in future studies to assess how attitudes develop as a result of repeated exposure to flipped classroom training.

Our findings show that medical students have varying perspectives and preferences regarding the flipped classroom approach, suggesting that a blended learning approach might be more appropriate for meeting their diverse learning needs. To create a dynamic, flexible, and student-centred learning environment that promotes engagement and active learning, medical educators should consider combining elements of both traditional and flipped teaching.

CONCLUSION

Medical students' choices for the flipped classroom format differ by year of study. Blended learning and online resources are popular, but traditional methods are still used, underlining the importance of adaptive teaching methodologies in medical education.

ACKNOWLEDGEMENT: None.
CONFLICT OF INTEREST: None.
GRANT SUPPORT AND FINANCIAL DISCLOSURE: None.

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Authors Contributions:

Aakash kumar: Substantial contributions to the conception and design of the work.
Kanza Mehmood : The acquisition and analysis of data for the work.
Sadia Rehman: Interpretation of data for the work.
Hassan Ali: Drafting the work.
Hina Moazzam: Reviewing it critically for important intellectual content.
Muhammad Faisal Fahim: Final approval of the version to be published.

Submitted for publication: 30-09-2024
Accepted after revision: 12-03-2026