



BMJ Open Experiences of Undergraduate Medical, Nursing Students and Faculty regarding Flipped Classroom: A Mixed Method Study at Private Medical University in Pakistan

Amber Shamim Sultan ¹, Rahila Ali,² Nida Zahid ³, Rozmeen Akbar,⁴ Mehdiya Ali,⁵ Sadia Fatima,⁴ Kulsoom Ghias,⁴ Russell Martins,⁵ Muhammad Tariq,⁶ Khairulnissa Ajani⁷

To cite: Sultan AS, Ali R, Zahid N, *et al.* Experiences of Undergraduate Medical, Nursing Students and Faculty regarding Flipped Classroom: A Mixed Method Study at Private Medical University in Pakistan. *BMJ Open* 2023;**13**:e070276. doi:10.1136/bmjopen-2022-070276

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2022-070276>).

Received 24 November 2022
Accepted 20 February 2023



© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to
Dr Amber Shamim Sultan;
amber.sultan@aku.edu

ABSTRACT

The 'flipped classroom (FCR)' is a teaching pedagogy where students are actively involved in the learning process. It reduces passivity, enables students to become active learners through reasoning and concept application and facilitates student interaction with their peers and instructors. This instructional approach enhances retention and decreases distraction by engaging students.

Objectives The purpose of this study was to train the faculty of the medical college and school of nursing in developing FCRs as an innovative teaching and learning strategy, to facilitate them in conducting flipped sessions for their students and to explore the experiences of medical, nursing students along with faculty members regarding the FCR they had attended and conducted.

Setting Private medical college.

Participants A total of 442 students from medical college and school of nursing and midwifery participated in the evaluation survey with a female to male ratio of 339:103. Students who attended the flipped class sessions were included in the study sample. Students who did not complete the forms were excluded from the study. Nine faculty members who attended the workshop, agreed to facilitate the FCR session were invited to participate in the focus group discussion.

Results Both medical and nursing students found FCR format stimulating. A significantly higher proportion of medical students (73%) found the FCR more engaging and interesting than a traditional lecture as compared with nursing students (59%) ($p=0.009$). Similarly, 73% of medical students believed the learning objectives of both the non-face-to-face and face-to-face sessions were shared with them as compared with the 62% of nursing students who believed the same ($p=0.002$). A significantly higher proportion of medical (76%) versus nursing (61%) students found the FCR format more useful for application of their theoretical knowledge into clinical practice ($p=0.030$).

Conclusion Students found the FCR more engaging and interesting in terms of applying theoretical knowledge into practice. Similarly, faculty found this strategy as effective but challenging in terms of involving and engaging

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This is a mixed methods study and was the first capacity-building teacher training study conducted across two health professions faculty.
- ⇒ Faculty development workshops were conducted to train faculty on how to conduct flipped classroom (FCR).
- ⇒ Is a single-centre study, those interested in FCR teaching format are more likely to participate which may create a response bias.
- ⇒ Only the clinical faculty trained and conducted sessions in clinical years, so the results cannot be generalised for faculty from basic sciences.

students in the learning process. It is recommended to conduct more FCR sessions for an interactive and student-centred learning, but proper planning of the session and using variety of technological tools to engage learners is a key to success.

BACKGROUND

With higher education being more accessible to the masses, the increased enrolment of students in classes has also created learner's diversity in terms of ability and background.¹ Furthermore, the problems surrounding effective learning are compounded by the fact that every student is unique and learns in different ways. To maximise each student's learning, teachers need to be aware of different learning styles and adjust their teaching strategies accordingly to best fit the students' needs.²

Different technological tools have been used by medical educators at different medical institutions and they are willing to restructure their classrooms in innovative ways. Advancement in technology has shifted

teaching to learning and the pedagogy from passive to active. It has moved from didactic lectures to modern classroom teaching where students are motivated to learn and are actively involved in the learning process.³

In undergraduate medical education, educational practices must consider the following facts: the learner is an active contributor in the learning process; learning occurs independently and in collaboration with peers; prior knowledge and previous experience form the basis of acquiring new knowledge; learning should relate to the understanding and management of real-life problems; and the need to understand that application of knowledge is crucial to the development of lifelong learning skills. Medical educators need to adapt teaching and learning approaches that promote critical thinking, problem solving and application of learnt concepts for motivating adult learners. The Accreditation Council for Graduate Medical Education 'stresses the value of enhancing the quality and quantity of formal teaching, a challenging task due to increased time constraints for both trainees and faculty members'.⁴ This new strategy, such as the 'flipped classroom' (FCR), have been used in a growing number of medical educational settings.

In several studies, blended learning approaches, like the FCR which use online technology along with instructor-led active learning strategies have shown favourable results.⁵ This model of classroom instruction relies primarily on student preparation outside of class to use in-class time for specific kinds of active learning activities, such as problem based learning or team based learning.⁶

Use of different technological tools provides an opportunity for educators to develop sessions and courses that improve student's willingness to participate and be successful in the learning process.^{1,7} Technological educational tools can enhance student engagement in the learning process, which results in meeting learning outcomes, and improves students' satisfaction.^{2,8}

The concept of FCR is grounded in the theories of self-regulation and socio-constructivism. In self-regulated learning theory, the learner is actively involved in the learning process, however the socio-constructivist theory focuses mainly on discussions and interaction inside class that will ultimately promote higher-order cognitive skills.⁹

Flipped class approach 'flips' the traditional lecture. The FCR model denotes a slightly different approach to in-class active learning, where students are responsible for learning the basic concepts on their own, usually through online videos. Teachers acquire this by either using their pre-recorded lectures or use ones that are already available on the internet. Teachers may also provide a few reading resources to study before coming to the class. The class time is then best used in a variety of active learning activities to reinforce concepts such as using clinical scenarios and case-based discussions.¹⁰

Instead of giving didactic lectures for knowledge acquisition followed by independent assignments/homework, the learner performs independent, self-paced didactic learning for knowledge acquisition followed by

classroom-based group assignments, discussion and/or problem-based learning. Learner-centric group discussions or problem-based learning facilitated by an educator helps create a community of learning and allows for peer-to-peer teaching, dialogue and support.¹¹

This approach allows educators to optimise their time and promotes educator-student interaction.¹² FCR not only encourages students to take responsibility for their own education¹² but allows a flexible environment where students can access the resource material at their own pace and in their own time. There is a limited data on the effectiveness of an FCR model in undergraduate medical and nursing education. The impact of this innovative teaching methodology is yet to be explored on the assessment of students' scores. The rationale for doing this research study was to do capacity building of faculty in terms of developing and conducting flipped class sessions at the Aga Khan University. It is anticipated that this approach will ultimately lead to increased student engagement and will keep them motivated to learn by completing pre-readings at their home. The face-to-face sessions can be used to discuss real-life case scenarios to enhance problem-solving and critical thinking skills.

STUDY OBJECTIVES

- ▶ To train faculty members from medical college and school of nursing and midwifery in conducting FCR.
- ▶ To enable the study participants to reflect on their experiences regarding their FCR sessions conducted and attended.

METHODOLOGY

This study was conducted to train the faculty in developing flipped class sessions and to acquire student and faculty perspectives regarding their experience of attending and conducting FCRs, respectively. Therefore, both quantitative and qualitative data collection methods were employed to obtain in-depth information about the flipped class sessions at the Aga Khan University (medical college & school of nursing and midwifery). Student evaluation forms and focus group discussion (FGD) were used to collect the data from the study participants. Three workshops were conducted during July 2019 to January 2020 for training faculty participants. Thirty-two faculty members attended the faculty development workshop on FCR. The three workshops were designed in a flip style format. Facilitation of flipped class session and later participation in the FGD as part of the research project was voluntary. Five faculty members from nursing and four from medical college conducted their session based on flip style format for their students and later participated in the FGD. After attending the workshops, the faculty from medical college and school of nursing were approached and assisted in developing their pre-class as well as in-class activities for a flipped class session (figure 1).

The pre-class activities included PowerPoint presentations, videos on EdPuzzle (<https://edpuzzle.com/>) along with quizzes to check students' understanding of the concept. A discussion board was created on Padlet (<https://padlet.com/>) to engage students virtually. Students were encouraged to complete the assigned tasks before coming to the face-to-face session (F2F). The pre-class activities were followed by F2F in class activities such as clinical case-based discussions to clarify the students' misconceptions and queries. An online freely available software called 'Kahoot' (<https://kahoot.com/>) was also used by some of the facilitators during the class to check student's prior knowledge and to facilitate student's engagement during class.

Once the facilitators conducted the F2F sessions, students were asked to fill out the session evaluation forms after giving written informed consent. The self-administered questionnaire focused on four main categories such as pre-class material, preparedness for the F2F session, learning acquired during F2F session and role of flipped class in enhancing student's learning. Demographic questions consisted of general information such as programme of study, year of study and gender. The questionnaire comprised 16 attributes which were scored on a 5-point Likert scale where 1 denoted strongly disagree, 3 was neutral and 5 meant strong agreement of the item. The questionnaire was developed based on literature review and was validated for content before it was administered. The newly developed evaluation form was validated by two medical educationist along with two faculty members from Basic sciences who are involved in undergraduate curriculum design and has expertise in teaching and learning. Data were analysed by using SPSS V.20. Frequencies and percentages were reported for categorical variables and presented via graphs. Opinions among the two groups namely medical students and nursing students were assessed by χ^2 and Fisher's exact tests. A p value of less than 0.05 was considered significant. Thematic analysis was done to analyse the qualitative data.

Patient and public involvement

No patient involved.

RESULTS

The total number of study participants is (n=442, 100%) with a female to male ratio of (n=339, 76%):(n=103, 23.3%) comprising medical (n=88, 20%) and nursing (n=354, 80%) students as shown in figures 2 and 3.

As shown in table 1, both groups found the flipped class format stimulating. However, a significantly higher proportion of medical students (73%) found flipped classes more engaging and interesting than a traditional lecture as compared with the nursing students (59%) (p=0.009). Similarly, a significantly higher proportion of medical students (73%) believed the learning objectives of both the pre-class and in class session were shared with

them as compared with the 62% of nursing students who believed the same (p=0.002).

A significantly higher proportion of medical students (76%) as compared with nursing (61%) found the flipped class to be useful for application of theoretical knowledge into clinical practice (p=0.030). A greater proportion of medical students (76%) believed flipped class helped them to establish a plan for achieving their goals as compared with nursing students (62%) (p value=0.036).

In addition, a higher proportion of nursing students (82%), compared with medical (71%) students found the class discussion as a useful tool to enhance oral communication skills (p=0.049). Greater percentage (82%) of medical students agreed that flipped class format activated prior knowledge as compared with nursing students (69%), however the difference was not statistically significant. A significantly higher proportion (80%) of students in the medical programme agreed to have more flipped class sessions in future versus 56% of nursing students (p≤0.001). Whereas (20%) and (23%) nursing students opposed or gave neutral response regarding more flipped class sessions should be scheduled in future.

Eighty-two per cent of medical students versus 69% nursing students believed that flipped class sessions helped them to activate their prior knowledge although the results were not statistically significant (p=0.062).

Regarding student's engagement, a significantly higher proportion of medical students (73%) versus 59% of nursing students agreed that the flipped class format was more engaging and interesting than a traditional lecture (p value=0.009). Regarding learning objectives were provided, a higher proportion of nursing students (19%) disagreed as compared with medical students (7%). However, the difference was not statistically significant. Similarly, a higher proportion of students from school of nursing (24%) neither agreed nor disagreed regarding flipped class format enabled learner to establish a concrete action plan for achieving the desired learning goals as compared with (18%) medical students. Students from both the entities (18%) neither agreed

Steps for conducting the workshop on "Engaging millenials through flipped classroom"

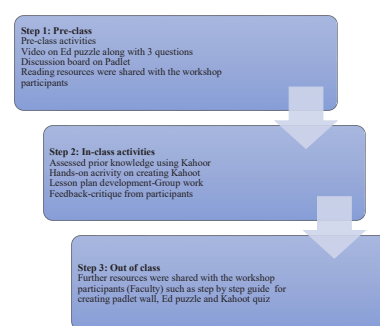


Figure 1 Steps for conducting the workshop on "Engaging Millenials through Flipped Classroom".

**Table 1** Comparison of FCR evaluation by medical and nursing students

Attributes	Scale	Total	MBBS	BSCN	P value
Clear instructions for the different components (non-face-to-face and face-to-face) were provided	Disagree	35 (8%)	5 (6%)	30 (9%)	0.168
	Neutral	69 (16%)	9 (10%)	60 (17%)	
	Agree	338 (77%)	74 (84%)	264 (75%)	
The learning objectives of pre-class and in class session were provided	Disagree	74 (17%)	6 (7%)	68 (19%)	0.020*
	Neutral	84 (19%)	18 (21%)	66 (19%)	
	Agree	284 (64%)	64 (73%)	220 (62%)	
The pre-reading material provided in non-face-to-face session helped to prepare for discussion in face-to-face session	Disagree	21 (5%)	4 (5%)	17 (5%)	0.956
	Neutral	54 (12%)	10 (11%)	44 (12%)	
	Agree	367 (83%)	74 (84%)	293 (83%)	
Sufficient time was provided before face-to-face session to gain basic knowledge of the topic being discussed	Disagree	40 (9%)	8 (9%)	32 (9%)	0.222
	Neutral	72 (16%)	9 (10%)	63 (18%)	
	Agree	330 (75%)	71 (81%)	259 (73%)	
Flipped class format helped student's ability to find the information using internet/library	Disagree	45 (10%)	6 (7%)	39 (11%)	0.499
	Neutral	90 (20%)	18 (21%)	72 (20%)	
	Agree	307 (70%)	64 (73%)	243 (69%)	
Flipped class format helped students to activate prior knowledge	Disagree	44 (10%)	6 (7%)	38 (11%)	0.062
	Neutral	81 (18%)	10 (11%)	71 (20%)	
	Agree	317 (72%)	72 (82%)	245 (69%)	
Flipped class format enabled learner to establish a concrete action plan to achieve their learning goals	Disagree	52 (12%)	5 (6%)	47 (13%)	0.036*
	Neutral	102 (23%)	16 (18%)	86 (24%)	
	Agree	288 (65%)	67 (76%)	221 (62%)	
Flipped class format encouraged students to actively participate in the learning process	Disagree	30 (7%)	5 (6%)	25 (7%)	0.360
	Neutral	81 (18%)	12 (14%)	69 (20%)	
	Agree	330 (75%)	71 (81%)	259 (73%)	
Flipped class format promote students to take responsibility of their own learning	Disagree	35 (8%)	8 (9%)	27 (8%)	0.881
	Neutral	85 (19%)	16 (18%)	69 (20%)	
	Agree	322 (73%)	64 (73%)	258 (73%)	
The flipped class format was more engaging and interesting than a traditional lecture	Disagree	77 (17%)	6 (7%)	71 (20%)	0.009*
	Neutral	94 (21%)	18 (21%)	76 (22%)	
	Agree	271 (61%)	64 (73%)	207 (59%)	
Flipped class format helped students to apply theoretical knowledge into clinical practice	Disagree	55 (12%)	7 (8%)	48 (14%)	0.030*
	Neutral	104 (24%)	14 (16%)	90 (25%)	
	Agree	283 (64%)	67 (76%)	216 (61%)	
Discussion during the face-to-face session-built student's confidence to speak	Disagree	17 (4%)	5 (6%)	12 (3%)	0.049*
	Neutral	72 (16%)	21 (24%)	51 (14%)	
	Agree	353 (80%)	62 (71%)	291 (82%)	
Face-to-face sessions helped students to develop critical reasoning skills	Disagree	19 (4%)	4 (5%)	15 (4%)	0.979
	Neutral	78 (18%)	16 (18%)	62 (18%)	
	Agree	345 (78%)	68 (77%)	277 (78%)	
The role of facilitator in the face-to-face session of the flipped classroom was useful	Disagree	16 (4%)	6 (7%)	10 (3%)	0.187
	Neutral	47 (11%)	10 (11%)	37 (11%)	
	Agree	379 (86%)	72 (82%)	307 (87%)	
Time allotted for the face-to-face session of the FCR session was adequate	Disagree	27 (6%)	3 (3%)	24 (7%)	0.342
	Neutral	61 (14%)	10 (11%)	51 (14%)	
	Agree	354 (80%)	75 (85%)	279 (79%)	

Continued

Table 1 Continued

Attributes	Scale	Total	MBBS	BSCN	P value
More flip class sessions should be organised in future	Disagree	78 (18%)	6 (7%)	72 (20%)	0.000*
	Neutral	95 (22%)	12 (14%)	83 (23%)	
	Agree	269 (61%)	70 (80%)	199 (56%)	

*Significant at p value <0.05 by using χ^2 /Fisher's exact test.
FCR, Flipped classroom.

nor disagreed regarding the development of critical reasoning skills via F2F session.

Qualitative data analysis

Data from the FGD were analysed through content analysis. Three coders were identified who independently reviewed the transcriptions and gave codes to each statement. From these derived codes, subthemes were generated which were further clustered and grouped together to form the following four themes.

Student engagement

Almost all the facilitators agreed that FCR strategy allowed their students to be more involved and engaged in the learning process. The students were more enthusiastic to learn, and they appreciated the use of FCR methods for teaching of important concepts. One of the facilitators cited that 'there was a new energy and spark in my class'. Hence, it was found that in almost all the FCR sessions, the student's involvement was improved, and their attention span was considerably increased.

Capacity building of faculty

Majority of the facilitators agreed that the technological tools such as EdPuzzle, Kahoot, etc that were used in FCR were new modalities for them which they had not used before. Hence, working on their sessions to convert them into FCR gave them an opportunity to learn newer

techniques and expand their horizons of teaching. One facilitator stated that 'it was a self-Learning experience for the faculty and teachers as well'. They believed that the use of FCRs as a teaching strategy was a bit challenging experience, but that helped them to learn new and innovative ways of teaching and became more comfortable with using different innovations to enhance their teaching skills.

Traditional versus innovative teaching

There were mixed views about offering traditional versus innovative teaching. Some of the facilitators agreed that this was a way better method of teaching the important concepts as it required more effort and active learning on the student's end, hence increasing their understanding of the basic concepts. One facilitator commented, 'I could see that students actually took charge of learning that particular topic even before coming to class, and that was the best thing'. One of the facilitators shared that the students preferred traditional methods instead of new innovative methods. Another facilitator shared students' views 'no, we don't want this; we need a lecture method'.

Challenges encountered in conducting FCR

Time constraint was the biggest challenge reported by some of the faculty members. Flipping a concept and designing it into an FCR takes a lot of time and commitment, especially when it is being done for the very first time. One of the facilitators commented that

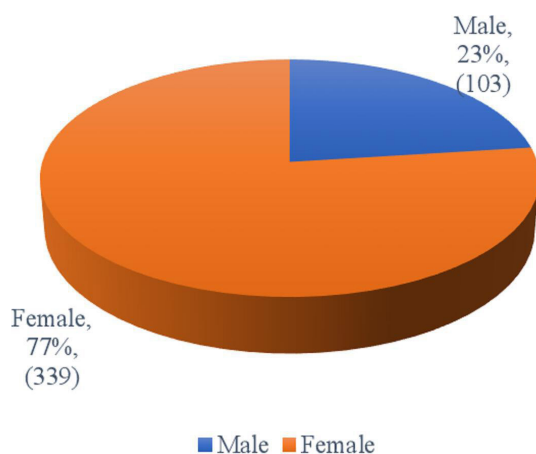
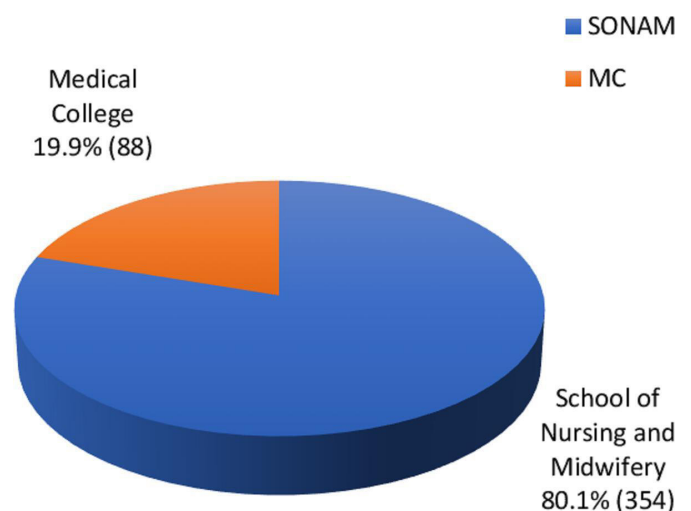

Participation by Gender

Figure 2 Distribution of student participants in flipped classroom evaluation surveys by gender.


Figure 3 Participation by Programme.



'the teachers need to really work hard and give time for the preparation of class' another said: 'Being a clinical faculty, it is very difficult to find time. This required an additional 1–2 weeks, to look for videos and Kahoot and other resources as pre-reading, which is difficult'.

Another major challenge the facilitator faced while conducting FCR session was that the students did not come prepared for the session. One of the facilitators commented: 'I think continuing with your plan and sticking with what you are going to teach the students is the main challenge'.

DISCUSSION

The term 'flipped classroom' (FCR) was created by Jonathan Bergmann and Aaron Sams, two high school chemistry teachers from Colorado, USA, in 2012.¹² Although the perceptions of undergraduate students towards FCRs have been gathered but specifically, a comparison of medical and nursing students' perceptions is lacking from literature. The remarkable comments gathered after conducting the flipped teaching session was that the FCR is an effective mode of delivering the content than the conventional didactic teaching. Like our findings, a study conducted at another health sciences university in Pakistan used a similar approach to teach medical students during a clinical rotation, reported that students found FCR as a better mode of teaching in their setup as well.¹³ Similarly, this model was preferred by participants of a flipped continued medical education classroom.¹⁴ Students believed that FCR method was more stimulating and engaging compared with the traditional instructional approach.

Students were aware of the learning objectives, and it really helped them to formulate their learning goals. It helped clarify any misconceptions and ample time was also provided to students during the F2F session to clarify any misconceptions with the facilitator.¹⁵ They also found it encouraging that they can apply their knowledge into clinical practice. As for the objectives of the session and the reading resources were provided well in advance, the students were able to acquire new knowledge and activate prior knowledge via case-based discussion held during the F2F session.

In addition to that, students also reported that their communication skills were also improved. Students' comments clearly articulated that this format activated their prior knowledge. The key to success of this teaching approach was that students took responsibility for their own learning. Provision of opportunity to interact with their peers increased, the availability of reading resources and opportunity to access the learning resources and do revisions as many times as required could be improved. Student's learning atmosphere is a combination of social, physical and psychosocial components. Applying techniques that boost the learning environment in classroom teaching enables learners to progressively understand the topic especially in undergraduate curriculum.¹⁶

The major challenge identified by the facilitators was to invest additional time to identify material for students and generate thought provoking scenarios for case-based discussion. Creating a discussion board on Padlet, uploading videos on EdPuzzle or using freely available such as Kahoot during F2F sessions to assess their prior knowledge was totally a new experience for facilitators. Majority were unfamiliar with this new technological tool to engage students prior as well as during the class. However, capacity building through conducting workshops and later one-on-one training helped them to create and identify relevant resources. The FCR approach is widely used in many disciplines of learning and education globally.¹⁷ The results of the study show that FCR is an effective pedagogy for both students and faculty at our institution. The ability to apply knowledge, develop confidence and engage in the learning process are some of the benefits that students appreciated in the flipped class format.

It was well received by both the entities, however, there were significant differences in their perceptions in a few areas. We compared the responses received from medical college and school of nursing students. Medical college students found flipped class format more helpful for application of theoretical concepts into clinical practice as compared with the nursing students. Similarly, in a comparative study of traditional versus FCR, authors found that the activities developed for FCR challenged students and provided them opportunity to apply their higher-order skills and to come up with practical solutions.¹⁸

Although students from both the entities agreed that FC is useful to establish a concrete action plan in achieving their learning goals, we saw a significantly higher percentage of medical students as compared with nursing students who found this approach useful. Another study reported that nursing students felt 'strange and uncomfortable' which indicates that innovative strategies need to be incorporated to motivate students towards this new approach.

Similarly, studies also considered FC as a useful approach to foster a learner-centred active learning environment for a health assessment course for undergraduate nursing students. However, faculty has found it demanding in terms of time and effort.¹⁹ The facilitators of this study felt that providing ample material to students and generating thought provoking scenarios for in-class sessions was challenging. Students from both the groups appreciated the flipped style teaching and agreed that more flipped sessions should be organised in future. Since the introduction of flipped class modality, students have widely appreciated the value of flipped class sessions and have said that there should be more FCR sessions on other topics.

Similarly, a study conducted on nursing students reported that incorporating blended approach by using innovative technological tool along with interactive classroom activities can enhance students learning but

not necessarily improved student satisfaction.²⁰ Our study results also indicates that more medical students as compared with nursing students were in favour of implementing this strategy in future. Angadi *et al* also reported that 76% students were in favour of having more FC sessions in future.²¹ It has been widely observed that students find the FCR approach a better option in terms of fulfilling the learning objectives than the conventional didactic teaching.

Students from both the groups appreciated the flipped style teaching and agreed that more flipped sessions should be organised in future. Since the introduction of flipped class modality, students have widely appreciated the value of flipped class sessions and have said that there should be more FCR sessions on other topics. FCR have also helped students build confidence to speak and take part in discussions. Verbal communication is essential for success. Literature supports flipped class sessions to improve communication skills of students both inside and out of class.²²

In another study by Zainuddin and Attaran, a comparison of flipped class with traditional teaching concluded that FCR was more engaging than traditional classroom and majority of the students had appreciated this methodology of teaching and learning.²² Our students found the flipped class format more engaging and interesting than a traditional lecture. Literature also supports role of FCR in promoting a positive learning experience for students.²³ Other studies also highlighted the benefits of FC in terms of student's engagement both inside and outside of class, more efficient use of classroom by using problem-based scenarios,²⁴ Another study highlighted that students valued case-based interactive discussions which were of clinical relevance to cases they would see in clinical practice.²⁵ Previous studies also emphasised the advantages of using FC such as: the improvement of students' learning autonomy, the easier discovery of blind spots in students' learning through students' demonstration of pre-class reading, the more flexible presentation of teaching materials to encourage students' classroom participation, the encouragement of students' cooperation inside and outside the class, class time was used more effectively, etc.²⁶ The COVID-19 epidemic has accelerated the digital transformation of teaching activities and may also be an opportunity to improve the integration of FC teaching into teaching design of medical education.²⁷

CONCLUSION

Study results concluded that the FCR approach was perceived as more engaging and stimulating than the traditional mode of delivering the content via lectures. Case-based discussions during FCRs were found to be helpful in developing students' communication skills and were also effective in application of theoretical knowledge into real clinical settings by promoting critical thinking, clinical reasoning and collaborative learning. We recommend that training workshops on how to design and

conduct FCRs should be conducted. It was highly recommended by the medical students to conduct more flipped class sessions in future for which there is a need to do more faculty development workshops on FCR.

Author affiliations

¹Department for Educational Development & Surgery, The Aga Khan University, Karachi, Pakistan

²Department for Educational Development, The Aga Khan University, Karachi, Pakistan

³Department of Surgery, The Aga Khan University, Karachi, Pakistan

⁴Department of Biological and Biomedical science, The Aga Khan University, Karachi, Pakistan

⁵Research Department, The Aga Khan University, Karachi, Pakistan

⁶Department of Medicine, The Aga Khan University, Karachi, Pakistan

⁷School of Nursing and Midwifery, The Aga Khan University, Karachi, Pakistan

Contributors ASS was the principal investigator of this research study and the guarantor. She facilitated three workshops on flipped classroom and contributed in the write up of the study, reviewed the manuscript. RA facilitated three workshops on flipped classroom, contributed in the write up of the study, reviewed the manuscript. NZ analysed and reviewed the data, reviewed the final manuscript. MA reviewed the manuscript, formatted the write up as per guidelines of the journal, contributed to the submission of the manuscript along with other required documents. RH conducted FGD and contributed in the write up of the qualitative section. SF conducted workshops and reviewed the manuscript. KG conducted workshops and reviewed the manuscript. RM transcribed Focus Group Discussion (Interview). MT reviewed the manuscript and KA provided support for faculty participation from school of nursing and reviewed the manuscript.

Funding The work was supported by Scholarship of Teaching and Learning (SOTL) (grant 72007).

Disclaimer The funders did not have any role in the study design, collection, analysis and interpretation of data, in the writing of report, and in the decision to submit the manuscript for publication. The researchers were completely independent from funders and all authors, external and internal, had full access to all the data (including statistical reports and tables) in the study and can take responsibility for the integrity of the data and the accuracy of the data analysis.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study involves human participants and was approved by The Aga Khan University Ethic Committee 2019-0999-2767. Ethical clearance was also obtained from the Institutional Review Board. Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information. Not Applicable.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Amber Shamim Sultan <http://orcid.org/0000-0002-0391-5615>

Nida Zahid <http://orcid.org/0000-0001-8812-9463>

REFERENCES

- 1 Ramsden P. *Learning to teach in higher education*. Routledge, 2003.
- 2 Smith M, Rogers J. Understanding nursing students' perspectives on the grading of group work assessments. *Nurse Educ Pract* 2014;14:112–6.



- 3 Adam S, Adam S. Blended and online learning: student perceptions and performance. *Interactive Technology and Smart Education* 2009;6:140–55.
- 4 Nasca TJ, Philibert I, Brigham T, et al. The next GME accreditation system -- rationale and benefits. *N Engl J Med* 2012;366:1051–6.
- 5 Bill T. The flipped classroom: online instruction at home frees class time for learning. *Educ Next* 2012;12:82–3.
- 6 Engel CE. Not just a method but a way of learning. the challenge of problem-based learning. 1997;2:17–27.
- 7 Johnson GB. *Student perceptions of the flipped classroom*. (Doctoral dissertation, University of British Columbia),
- 8 Gilboy MB, Heinerichs S, Pazzaglia G. Enhancing student engagement using the flipped classroom. *J Nutr Educ Behav* 2015;47:109–14.
- 9 Sun Z, Xie K, Anderman LH. The role of self-regulated learning in students' success in flipped undergraduate math courses. *The Internet and Higher Education* 2018;36:41–53.
- 10 Mehta NB, Hull AL, Young JB, et al. Just imagine: new paradigms for medical education. *Acad Med* 2013;88:1418–23.
- 11 Young TP, Bailey CJ, Guptill M, et al. The flipped classroom: a modality for mixed asynchronous and synchronous learning in a residency program. *West J Emerg Med* 2014;15:938–44.
- 12 Galindo I. *Flip your classroom: reach every student in every class every day*. by jonathan bergmann and aaron sams. Alexandria, Va: The Association for Supervision and Curriculum Development, 2012: ix–112.
- 13 Zafar A. Flipped class - making that one hour effective in a resource constrained setting. *J Coll Physicians Surg Pak* 2016;26:795–7.
- 14 Stephenson CR, Wang AT, Szostek JH, et al. Flipping the continuing medical education classroom: validating a measure of attendees' perceptions. *J Contin Educ Health Prof* 2016;36:256–62.
- 15 Fatima SS, Arain FM, Enam SA. Flipped classroom instructional approach in undergraduate medical education. *Pak J Med Sci* 2017;33:1424–8.
- 16 Dunham L, Dekhtyar M, Gruener G, et al. Medical student perceptions of the learning environment in medical school change as students transition to clinical training in undergraduate medical school. *Teach Learn Med* 2017;29:383–91.
- 17 Veeramani R, Madhugiri VS, Chand P. Perception of MBBS students to. *Anatomy & Cell Biology* 2015;48:138–43.
- 18 Kim D. Flipped interpreting classroom: flipping approaches, student perceptions and design considerations. *The Interpreter and Translator Trainer* 2017;11:38–55.
- 19 Choi J, Lee SE, Bae J, et al. Undergraduate nursing students' experience of learning respiratory system assessment using flipped classroom: a mixed methods study. *Nurse Education Today* 2021;98:104664.
- 20 Missildine K, Fountain R, Summers L, et al. Flipping the classroom to improve student performance and satisfaction. *J Nurs Educ* 2013;52:597–9.
- 21 Angadi NB, Kavi A, Shetty K, et al. Effectiveness of flipped classroom as a teaching-learning method among undergraduate medical students - an interventional study. *J Educ Health Promot* 2019;8:211.
- 22 Zainuddin Z, Attaran M. Malaysian students' perceptions of flipped classroom: A case study. *Innovations in Education and Teaching International* 2016;53:660–70.
- 23 Steen-Utheim AT, Foldnes N. A qualitative investigation of student engagement in A flipped classroom. *Teaching in Higher Education* 2018;23:307–24.
- 24 Pozo-Sánchez S, López-Belmonte J, Fuentes-Cabrera A, et al. Twitch as a techno-pedagogical resource to complement the flipped learning methodology in a time of academic uncertainty. *Sustainability* 2021;13:4901.
- 25 Chowdhury TA, Khan H, Druce MR, et al. Flipped learning: turning medical education upside down. *Future Healthc J* 2019;6:192–5.
- 26 Fulton K. Upside down and inside out: flip your classroom to improve student learning. *Learn Lead Technol* 2012;39:12–7.
- 27 Tsao Y-P, Yeh W-Y, Hsu T-F, et al. Implementing a flipped classroom model in an evidence-based medicine curriculum for pre-clinical medical students: evaluating learning effectiveness through prospective propensity score-matched cohorts. *BMC Med Educ* 2022;22:185:185..