

A comparative study of students' performance in flipped classroom and structured interactive session teaching learning method in Conservative Dentistry and Endodontics

Sushmita Shrestha^{1*}, Mannu Vikram¹, Navin Agrawal¹, Ashok Ayer¹, Ashish Shrestha²

¹Department of Conservative Dentistry and Endodontics, BP Koirala Institute of Health Sciences, Dharan, Nepal,

²Department of Oral Pathology, BP Koirala Institute of Health Sciences, Dharan, Nepal

ABSTRACT

Introduction: Flipped classroom is an element of blended learning, integrating both face-to-face learning in the class through group discussion and distance learning outside the class by watching video lessons and online collaboration. The objective of the study was to introduce and assess the effectiveness of flipped classroom in teaching and learning of Conservative Dentistry and Endodontics and to understand the perspective of students about the same. **Methods:** Third year undergraduate dental students were randomly divided into two groups: structured interactive session group and flipped classroom group. Structured interactive session group had their class taken in the traditional manner while the flipped classroom group was given power point presentation and videos beforehand so that students came to class being prepared. The in class time was utilized for group discussions and peer exercises. Same set of questions including multiple choice questions (MCQs) and problem based questions (PBQs) validated by the faculties involved in the research was used for assessment. A questionnaire was then provided to students regarding their perception of flipped classroom method. **Results:** Among the 41 students, 19 students were in structured interactive session group and 22 were in flipped classroom group. The mean MCQ and PBQ score in structured interactive session group was 69.47 and 59.39 respectively whereas it was 73.17 and 66.55 respectively in flipped classroom group. **Conclusions:** The performance of flipped classroom group was better in both MCQs and PBQs. Students preferred flipped classroom method and were ready to accept it as their teaching learning modality.

Keywords: Flipped classroom, teaching and learning method, undergraduate dental students.

*Correspondence:

Dr. Sushmita Shrestha
Department of Conservative Dentistry and Endodontics
BP Koirala Institute of Health Sciences
Dharan, Nepal
Email: drsushmitashrestha@gmail.com
ORCID iD: <https://orcid.org/0000-0001-8724-7257>

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INTRODUCTION

In modern days, increasing interest of medical educationists in teaching and learning have raised concerns over passively transferring knowledge to learners using traditional lectures. This has created a pressure for medical education to move towards more student-centered, active learning.¹⁻³ It is believed that flipped classrooms (FCR) create a more student-centered, active learning environment than traditional lectures.⁴ There is adequate evidence supporting flipped classroom as an effective method of teaching and learning in all the higher education including medical education.⁵⁻¹¹

Recently, FCR approach has even been proposed as a new paradigm in medical education.¹² Various health professions have adopted this instructional approach into their curricula. An overwhelming positive response from students who attended flipped courses in health professions was found in the recent review. More specifically, students were highly satisfied with pre-class video lectures as they could be accessed at any time and as often as desired. Students also highly regarded small group discussion-based activities in face-to-

face sessions because these sessions helped to increase their motivation to learn, and enhance their level of engagement, and interest in the subject matter.¹³ Traditionally, the teaching of Conservative Dentistry and Endodontics in many dental schools has been in large-sized lectures. Although a lecture is an efficient way to convey a large amount of information to a large group of students, teacher-centered lectures have been criticized for failing to engage students and develop higher-level cognitive and interaction skills.^{14,15} FCR is an instructional approach in which foundational knowledge is delivered online for students to study at their own pace, and class time is devoted only to active learning activities to deepen students' comprehension of the content.¹⁶ The goal of flipped classroom method is to make learning more student centered and to promote the development of higher level learning outcomes on Bloom's taxonomy.¹⁷

The FCR method has received much attention in health sciences education in recent years. However, its application in Conservative Dentistry and Endodontics education has not been well investigated. In this research, we introduced the flipped classroom method in the teaching and learning of Conservative Dentistry and Endodontics and helped to identify whether flipped classroom increases the students' learning ability of the subject. This research will also help to recognize the perspective of the students toward FCR as a potential learning tool.

METHODS

This quantitative study was conducted at the Department of Conservative Dentistry and Endodontics, BP Koirala Institute of Health Sciences, Nepal from November 2019 to February 2020. Approval from Institutional Review Committee, BPKIHS (Reference number 496/075/076-IRC) and Research Committee, BPKIHS (Reference number Acd.175/075/076) were obtained. The third-year undergraduate dental students who gave consent to participate in the study and were present on the day of intervention were included in the study. Enrollment of the students in between the intervention group and structured interactive session (SIS) group was done on the basis of randomized allocated method using a simple random sampling procedure.

The faculties involved selected a topic for intervention and for the assessment of students' knowledge ten multiple choice questions (MCQs) each carrying one mark and for critical thinking ability one problem-based question of eight marks pertinent to the topic was decided and validated. For the smooth conduction of the FCR method, various tools to be used during the process were prepared which included power point presentation, videos, study materials as well

as tutor guide. Self-addressed questionnaires regarding student perception of the intervention method and the feedback form were decided upon.

The faculty allocated for the FCR group formed a WhatsApp group inclusive of all the enrolled students and faculties where power point presentation along with all the study materials was shared. The students were encouraged to put forward their doubts for active discussion on the online platform. They were also instructed to come for classes after going through the materials provided and were requested not to share these materials with the SIS group members. On the day of intervention, SIS and FCR were undertaken simultaneously in different classrooms by allocated faculties thus limiting contamination bias. This way it was ensured that there was not any crossover of students of different groups. The SIS group had a lecture with a question-answer session at the end followed by an assessment. The FCR group was further divided into small groups for effective discussion and demonstrations which was followed by an assessment at the end. The students were then given a questionnaire comprising seven close-ended questions and one open-ended question as feedback. A different faculty who was blinded to the allocation assessed the performance of the students.

Data were entered in Microsoft Excel and statistical analysis was done using statistical packages for the social sciences (SPSS) version 11.0 software. Data is presented as percentage, mean, standard deviation and calculated for descriptive statistics. Mean scores was calculated using the scores of the students in MCQ and PBQ for both the groups. For the inferential statistics, chi-square test was used to find out the association between categorical variable and groups. T-test was used to find out significant difference of mean MCQ and PBQ scores between SIS and FCR groups and the probability of significance was set at 5%.

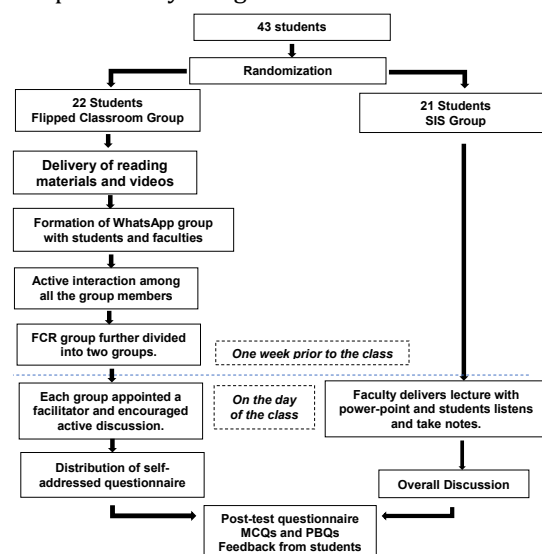


Figure 1: Schematic outline of the research conduction

RESULTS

Of the total 43 students, 41 gave consent. After randomization, there were 19 students in conventional lecture (males=10; females=9) and 22 in flipped classroom group (males=13, females=9). The response of the students was better among the FCR group compared to the SIS group both in MCQ and PBQ, however significantly better in the PBQ responses (Table 1). Majority of the students agreed that Flipped classroom was more engaging and provided opportunity to interact and communicate with others (Table 2). On qualitative review of the feedback, the students felt that FCR was more interesting, and they were ready to accept it as their teaching and learning method. Moreover, they also inferred the role of an inductive learning environment for better output (Table 3).

Table 1: Mean MCQ and PBQ scores of SIS and FCR group

S.N	Group	SIS Group (n=19)		FCR Group (n=22)		p-value*
		Mean±SD	95% CI of the difference (lower- upper)	Mean±SD	95% CI of the difference (lower-up- per)	
1.	MCQ	6.95±2.09	5.94 - 7.96	7.18±1.14	6.68 - 7.69	0.65
2.	PBQ	4.10±0.96	3.68 - 4.63	5.00±1.27	4.61 - 5.56	0.016**

*t-test, **statistically significant

Table 2: Students' perception of FCR

S.N	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1.	The FCR is more engaging than traditional classroom	13	8	0	1	0
2.	All flipped videos in this course are interesting.	4	14	4	0	0
3.	I like watching short flipped videos	5	14	2	0	1
4.	FCR gives a chance to communicate with other friends.	15	5	2	0	0
5.	The FCR gives me more time to practice subject outside the class.	8	13	1	0	0
6.	The teacher's feedback is very important in FCR.	6	14	2	0	0
7.	The activity in the classroom should be more interactive and communicative.	11	8	2	0	1

Table 3: Students open feedback

S. N.	Fields	Suggestions
1.	Content of course structure	More clinical cases with case scenarios and pictures may help to relate more effectively with the course content
		More videos will be less boring
		More practicals and demonstrations will help to clear any doubts then and there
2.	Learning Environment	Search, research and present sessions for students as well may help to retain what is learnt.
		More interaction during discussions in the in class time
		More interaction and discussions in out of the class groups in internet
		Loud voice of the facilitator
3.	For out of the class activities	Audio visual aid during small group discussions
		Allocation of particular time for group work and interaction
		Not very lengthy off the class discussions and assignments

DISCUSSION

A FCR in recent days is emerging as a promising blended method of teaching and learning in health professions education.

Flipped classroom ensures more face-to-face time between learners and tutor which in turn leads to more interaction and collaborations between not just teacher and students but between students as well. One of the advantages of FCR is the fact that students can learn at their own pace. Since the contents would have been provided before the actual class it also encourages students to come to class prepared, raise their doubts and have a healthy discussion about the same. Practical setbacks like missing classes and concerns over students attending classes just for attendance also becomes less significant. Since most of the contents are delivered via online platform there is opportunity to create richer content.¹⁸ In the FCR approach, classroom-based time is spent in the higher levels of Bloom's taxonomy: apply, analyze, and evaluate as compared to the traditional didactic classroom where in it is focused on; remember and understand according to the Bloom's taxonomy.¹⁸

FCR utilizes case or problem-based discussions where each student has an equal opportunity to speak and be heard. It is an instructor facilitated, learner centered activity which improves understanding and increases clinical application of acquired knowledge in addition to earning critical lifelong learning skills.¹⁹⁻²¹ Active participation of students during the discussions and raising of doubts ensured that they came to the class being prepared. It has been well established that adult learners have ability to make practical application of knowledge gained through independent study during learner centered activities.¹⁹ This finding is consistent with present study where the performance of students of flipped classroom group was found to be better in the PBQs than in

the MCQs. This could point out that the flipped classroom induced deep learning in the students such that they could understand the problems and concepts better. The similar scores of students in both the groups could indicate that FCR may be as effective as traditional classroom method if not better, when the students were assessed based on recall type questions.

The use of FCR approach is becoming increasingly common in medical education. Hew et al.²² in his meta-analysis of well controlled studies showed significant inclination towards flipped classrooms over conventional classrooms for health professionals. Additionally, it was revealed that FCR proved to be more effective with the use of quizzes at the beginning of face to face time. More students were found to have preference for flipped to traditional classrooms which is similar to the results in our research. Chen et al.¹⁹ noted that FCR is a promising teaching approach that increases learner motivation and engagement. This finding is consistent with current research where most of the students felt that flipped classrooms are more engaging than traditional classes. Most of the students felt that flipped classroom gave them more time to practice the topic outside the classroom and there was more interaction in the flipped classroom method. Although learning in FCR has many advantages, transitioning to the FC model can be challenging for both learners and educators. FCR is most effective when learners have completed their preparatory work and are ready to actively participate in classroom discussions. This differs from traditional teaching models in which learners rely on teachers to acquire knowledge and require little preparation for lessons. Getting busy learners ready for class can be challenging and requires intrinsic learner motivation. This can be better understood by seeking students' feedback to make the FC method more acceptable.

A growing body of literature indicates the popularity of this method among trainees, and educators. However, there is broad consensus that more rigorous studies are needed to generate evidence for or against the use of FCR in medical education. A frequently evaluated metric for knowledge and performance improvement is the immediate posttest result, which has been used as criterion for evaluation in this study. Rose et al.²³ and Graham et al.²⁴ revealed that emergency medicine and internal medicine residents improved their immediate post-test results with the FC approach, consistent with the post-test results of the current study. Although promising, the next question posed by educators was whether these effects were sustainable. To find out Rose et al.²³ and Martinelli et al.²⁵ did study of 25 internal medicine and 26 anesthesiology residents

respectively which showed that the improved knowledge acquisition after FCR persisted months later. Furthermore, study done by Day²⁶ found that applying the FC approach to an anatomy course resulted in higher performance in both anatomy and subsequent kinesiology courses, and improved long-term retention of critical thinking skills which was able to be transferred to other courses as well.

We as investigators can only request the students to come prepared for the sessions and not share the study materials with the other group members but cannot ensure it. This can be considered as a limitation of the study as it may lead to contamination bias. The study only aimed to understand the perception of students taking part in the flipped classroom but did not assess the perception of teachers taking such class. More longitudinal studies considering all these factors and the longevity of the acquired knowledge by FCR would bridge the current gap of knowledge in this field.

CONCLUSIONS

The students in FCR group definitely performed better in problem-based questions. Even though the difference was not significant the students of the FCR group scored more in the MCQs. A study of greater sample size with longer duration of time and multiple number of sittings is required to confirm this result. Students felt that introduction of FCR will help them turn the conventional classroom into more interactive and student friendly one. They seemed to enjoy FCR more and also felt that use of videos and practical sessions will help to enhance their learning. Even though few students felt that FCR was too lengthy most students were ready to accept FCR as their teaching learning modality.

CONFLICTS OF INTEREST: None declared

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REFERENCES

1. Prober CG, Heath C. Lecture halls without lectures- A proposal for medical education. *N Engl J Med.* 2012;366(18):1657-9. DOI: 10.1056/NEJMp1202451 PMID: 22551125.
2. Prober CG, Khan S. Medical education reimaged: A call to action. *Acad Med.* 2013;88(10):1407-10. DOI: 10.1097/ACM.0b013e3182a368bd PMID: 23969367.
3. Schwartzstein RM, Roberts DH. Saying goodbye to lectures in medical school - paradigm shift or passing

- fad? *N Engl J Med.* 2017;377(7):605–7. DOI: 10.1056/NEJMp1706474 PMID: 28813217.
4. Young Hwan L, Kyong-Jee K. Enhancement of student perceptions of learner-centeredness and community of inquiry in flipped classrooms. *BMC Med Educ.* 2018;18:242. DOI: 10.1186/s12909-018-1347-3 PMID: 30352591.
 5. O’Flaherty J, Phillips C. The use of flipped classrooms in higher education: A scoping review. *Internet High Educ.* 2015;25:85–95. DOI: 10.1016/j.iheduc.2015.02.002.
 6. McLaughlin JE, Roth MT, Glatt DM, Gharkholonarehe N, Davidson CA, Griffin LM. The flipped classroom: a course redesign to foster learning and engagement in a health professions school. *Acad Med.* 2014;89(2):236–43. DOI: 10.1097/ACM.0000000000000086 PMID: 24270916.
 7. Khanova J, Roth MT, Rodgers JE, McLaughlin JE. Student experiences across multiple flipped courses in a single curriculum. *Med Educ.* 2015;49(10):1038–48. DOI: 10.1111/medu.12807 PMID: 26383075.
 8. Khandelwal A, Nugus P, Elkoushy MA, Cruess RL, Cruess SR, Smilovitch M. How we made professionalism relevant to twenty-first century residents. *Med Teach.* 2015;37(6):538–42. DOI: 10.3109/0142159X.2014.990878 PMID: 25594336.
 9. Sharma N, Lau CS, Doherty I, Harbutt D. How we flipped the medical classroom. *Med Teach.* 2015;37(4):327–30. DOI: 10.3109/0142159X.2014.923821 PMID: 24934251.
 10. Kalaian SA, Kasim RM. Effectiveness of various innovative learning methods in health science classrooms: A meta-analysis. *Adv Health Sci Educ Theory Pract.* 2017;22(5):1151–67. DOI: 10.1007/s10459-017-9753-6 PMID: 28091976.
 11. Hew KF, Lo CK. Flipped classroom improves student learning in health professions education: A meta-analysis. *BMC Med Educ.* 2018;18(1):38. DOI: 10.1186/s12909-018-1144-z PMID: 29544495.
 12. Mehta NB, Hull AL, Young JB, Stoller JK. Just imagine: New paradigms for medical education. *Acad Med.* 2013;88(10):1418–23. DOI: 10.1097/ACM.0b013e3182a36a07 PMID: 23969368.
 13. Ramnanan CJ, Pound LD. Advances in medical education and practice: Student perceptions of the flipped classroom. *Adv Med Educ Pract.* 2017;8:63-73. DOI: 10.2147/AMEP.S109037 PMID: 28144171.
 14. Gilboy MB, Heinerichs S, Pazzaglia G. Enhancing student engagement using the flipped classroom. *J Nutr Educ Behav.* 2015;47:109-14. DOI: 10.1016/j.jneb.2014.08.008 PMID: 25262529
 15. Zheng M, Bender D, Nadershahi N. Faculty professional development in emergent pedagogies for instructional innovation in dental education. *Eur J Dent Educ.* 2017;21(2):67-78. DOI: 10.1111/eje.12180 PMID: 26663694
 16. Bergmann J, Sams A. Flip your classroom: Reach every student in every class every day. Washington DC: International Society for Technology in Education; 2012. 120-190p
 17. Krathwohl DR. A revision of Bloom’s taxonomy: An overview. *Theory into Practice.* 2002;41:212-18. DOI 10.1207/s15430421tip4104_2
 18. Bloom BS. Taxonomy of Educational Objectives: The Classification of Educational Goals. Handbook I. Michigan, USA: Longmans, Green and Co Ltd; 1956. 403p
 19. Chen F, Lui AM, Martinelli SM. A systematic review of the effectiveness of flipped classrooms in medical education. *Med Educ.* 2017;51(6):585–97. DOI: 10.1111/medu13272 PMID: 28488303.
 20. French H, Gray M, Gillam-Krakauer M, et al. Flipping the classroom: a national pilot curriculum for physiology in neonatal-perinatal medicine. *J Perinatol.* 2018;38(10):1420–27. DOI: 10.1038/s41372-018-0185-9 PMID: 30087455.
 21. Izatt S, Gray M, Dadiz R, French H. Development and implementation of a national neonatology flipped classroom curriculum. *J Grad Med Educ.* 2019;11(3):335–36. DOI: 10.4300/JGME-D-18-00907.1 PMID: 31210868.
 22. Hew KF, Lo CK. Flipped classroom improves student learning in health professions education: a meta-analysis. *BMC Med Educ.* 2018;18(1):38. DOI: 10.1186/s12909-018-1144-z PMID: 29544495.
 23. Rose E, Claudius I, Tabatabai R, Kearl L, Behar S, Jhun P. The Flipped Classroom in Emergency Medicine

- Using Online Videos with Interpolated Questions. *J Emerg Med.* 2016;51(3):284-91. DOI: 10.1016/j.jemermed.2016.05.033 PMID: 27381954.
24. Graham KL, Cohen A, Reynolds EE, Huang GC. Effect of a flipped classroom on knowledge acquisition and retention in an internal medicine residency program. *J Grad Med Educ.* 2019;11(1):92-7. DOI: 10.4300/JGME-D-18-00536.1 PMID: 30805104.
25. Martinelli SM, Chen F, DiLorenzo AN, et al. Results of a flipped classroom teaching approach in anesthesiology residents. *J Grad Med Educ.* 2017;9(4):485-90. DOI: 10.4300/JGME-D-17-00128.1 PMID: 28824763.
26. Day LJ. A gross anatomy flipped classroom effects performance, retention, and higher-level thinking in lower performing students. *Anat Sci Educ.* 2018;11(6):565-74. DOI: 10.1002/ase.1772 PMID: 29356452.