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Conventional lectures vs the flipped classroom: Comparison of teaching models in undergraduate curriculum

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ABSTRACT

Education has been in the forefront of a catalyzing change due to the advent of technology and newer ideologies that has revolutionized today's classrooms. The educators are looking into newer teaching models to produce successful graduates in the current era. Primary research on a new pedagogy technique known as 'The flipped classroom' has been positive and its implementation in the undergraduate dental curriculum has been the least explored in educational research. The aim of this study was to compare the academic performance of undergraduate dental students using conventional lectures and 'The Flipped Classroom' for the subject of Periodontics. This retrospective study was conducted in two groups of undergraduate students who belonged to two academic years: Group I 2016 (n=75); Group II 2017 (n=75). Group I students learned the subject of Periodontology with conventional lectures whereas, Group II students were taught with 'The Flipped Classroom' where subject videos were viewed prior to the class session and interactive in-class activities were employed. The academic performance (summative assessment) of the students was evaluated using a written examination conducted at the end of final year of their undergraduate course. The comparison of the summative assessment was performed using independent t-test. The academic performance of Group II students (140.03 ± 7.14) was better than Group I students (129.21 ± 11.43) and statistically significant with p-value 0.000. Our implementation of the flipped classroom for Periodontology topics showed a promising platform for technology in education and with a significant improvement in the student's academic performance when compared to traditional lectures.



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INTRODUCTION

The students of this millennial generation are under constant evolution similar to the technological advancement in their era. The educational reforms

are taking advantage of the technology and the consumption habits to make learning more engaging and memorable (Prober CG 2012). The main drawbacks of conventional didactic lectures were that they lack mechanisms for ensuring intellectual engagement to the topic, student's attention diminishes quickly and they are ill-suited to teach higher order skills like application and analysis (Bonwell C 1996; Huxham M 2005; Young M *et al.*, 2009). So, the conventional mode of teaching cannot harness the student's potential, especially in subjects like Periodontics where the didactic lectures are shown to have a limited potential to teach the subject (Lee C and Kim S-W 2018). Alternative pedagogy models such as the flipped classroom, the

blended learning, multiple interactive learning algorithm (MILA) have been on the rise to maintain the interest of today's digital generation in the classroom.

The novel pedagogy technique, 'The Flipped Classroom' was pioneered by two Colorado-based high school science teachers Jonathan Bergmann and Aaron Sams (Bergmann J and Sams A 2012). It is based on inverting the routine classroom where what is normally done in class is flipped or switched with what is normally done by students out of the class. So, the course content in the form of videos or other materials which is usually dealt within the classroom is given to the students to read at home and assimilate the knowledge. Following which, the students are subjected to teacher-guided discussions or problem-based learning within the classroom to critically analyze and actively engage with the course material. The class time which conventionally involves didactic lectures and direct instructions can be better utilized with engaging discussions and interactive learning activities.

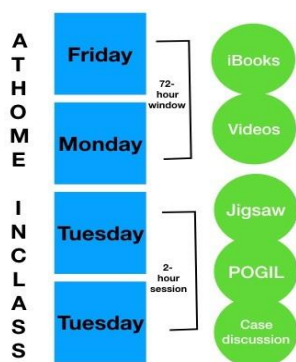


Figure 1: Overview of the Flipped Classroom Model

The advocates of 'The Flipped Classroom' model list numerous advantages and they trump the traditional methods in various aspects of learning. It allows students to read the course content at their own pace and they are also keen on interacting with other students to have a team-based learning approach. It has been shown to actively engage students with course material and the teachers have numerous opportunities to interact with the students and to collectively assess their learning through various activities and discussions (Nouri J 2016). The educators have long been lamenting that the students come to class without completing their homework and assignments and are ill-prepared in the class (Young J 2002). In flipped classrooms, the active learning activities have been shown to increase student's accountability for class preparation and attendance (Ferreri SP and O'Connor SK 2013; Persky A *et al.*, 2014).

The rise in the flipped classrooms has been observed in various health science fields, like medical and dental education, nursing, pharmacology, and public health (Crothers AJ *et al.*, 2017 Njie-Carr VPS 2017; Mc Laughlin JE *et al.*, 2014; Howard SW *et al.*, 2017). A systematic review on the use of flipped classroom in medical education included nine studies and observed that the learning outcomes were similar to that of conventional lectures, but the student satisfaction was consistently greater in a flipped classroom (Chen F *et al.*, 2017). Only one study assessed the effectiveness of a flipped classroom in learning periodontal diagnosis and treatment planning using pre- and post-session quizzes and surveys. It was concluded that flipped classrooms improved their quiz scores and it was well received by the students. So, in the dental arena, flipped classrooms have been implemented but there is limited data to support its effectiveness and that warrants a research focus in this lacuna. Thus, the aim of this study was to evaluate and compare the academic performance of undergraduate dental students in the subject of Periodontology with the use of traditional lectures and 'The Flipped Classroom' model.

MATERIALS AND METHODS

This retrospective study was conducted in a single center i.e., Saveetha Dental College and Hospital, Tamil Nadu, India. The study was approved by the Institutional Review Board (IRB NO). The subject of Periodontology was taught in the final year of the undergraduate dental curriculum and the students enrolled in two academic years were divided into two groups: Group I 2016 (n=75) and Group II 2017 (n=75). Group I students were taught the subject of Periodontology using conventional lectures and Group II students were digitally engaged using the 'The Flipped Classroom' model of teaching. The subject of Periodontology was split into three modules which covered from basics and pathogenesis of the periodontal disease to diagnosis, risk assessment, treatment planning and periodontal therapy. Each module consisted of five lecture classes covering the various topics and the duration of each class was 2 hours [Table 1]. The Group I students were taught these periodontology topics using the traditional model of lectures whereas, the Group II students were taught using the 'The Flipped Classroom' model. The Group I students were given the same course material as the other group, but they were not divided into groups for discussion or in-class activities, instead the content was delivered as a didactic lecture. This was followed by doubts session where the instructor clarified any misconceptions on the topic. Both the groups had the same contact hours for the

Table 1: Overview of Periodontology Topics

LECTURE	CORE PERIODONTOLOGY TOPIC
MODULE 1	<i>Basics and Pathogenesis of Periodontal Disease</i>
Lecture 1	Basic Tissues- Age Changes
Lecture 2	Defense Mechanisms- GCF, Saliva, Immunology
Lecture 3	Etiology- Plaque, Calculus
Lecture 4	Other Risk Factors- Systemic influence, TFO, Iatrogenic factors and Habits
Lecture 5	Pathogenesis- Stage of gingivitis, Periodontal Pocket, Bone loss pattern
MODULE 2	<i>Diagnosis, Risk Assessment and Treatment Planning</i>
Lecture 6	Classification- Acute gingival diseases, abscesses
Lecture 7	Gingival enlargement and Desquamative gingivitis
Lecture 8	Types of Periodontitis
Lecture 9	Clinical Diagnosis, Radiographic diagnosis, Advanced diagnostic aids
Lecture 10	Prognosis, Treatment planning and Host Modulation
MODULE 3	<i>Periodontal therapy</i>
Lecture 11	Phase I therapy- Scaling, Antimicrobial therapy, Occlusal therapy, Local drug delivery, and treatment in Medically compromised patients
Lecture 12	Phase II- Surgical phase- General Principles, Curettage, Gingivectomy, Flap surgery, Mucogingival Surgery
Lecture 13	Osseous Surgery- Resective and Regenerative therapy
Lecture 14	Interdisciplinary management- Endo-perio, Ortho-perio, Furcation management
Lecture 15	Supportive Periodontal Therapy

Table 2: Independent t-test for comparing summative assessment marks between two groups of undergraduate dental students

Variable	Groups	n	Mean±SD	t-value	p-value
Summative Assessment	Group I	75	129.21±11.43	-6.94	0.000
	Group II	75	140.03±7.14		

completion of the Periodontology module (Group I and II=30 hours).

The Flipped Classroom

The components of the flipped classroom such as the 'at home' assignments and in-class activities have been diagrammatically represented in [Figure 1].

At home

The course material included 7-minute lecture videos of the different Periodontology topics and eBooks, where the videos were embedded along with course content were made available for the students to download and view electronically in a 72-hour window period prior to the in-class session. The students were also asked to read the eBook of the particular lecture topic at home and also engage in multiple choice questions given at the end. The students were also instructed to review the course material prior to attending the class the following day.

In-class session

In the classroom, the first 20 minutes were engaged by playing the lecture videos again as a reinforcement and the students were divided into smaller groups (4-5 students). The instructor takes time to clarify any misunderstanding or misconception based on the week's assigned reading and

listening to videos. The in-class exercises were designed based on Peer-led learning, Critical thinking exercises, Jigsaw technique, Process Oriented Guided Inquiry Learning (POGIL), Case-based discussions and the appropriate exercises were chosen to the topic's demand. The 2-hour class was split into 20-minute sessions and it was trailed by in-class activities. The students were actively engaged with various in-class exercises and the instructor was involved in the construction of knowledge on the respective Periodontology topic.

The academic performance (summative assessment) was gauged by a written examination conducted at the end of the academic year of the undergraduate dental program. The examination evaluates the theoretical knowledge with thirty multiple choice question, two essay questions and five short essays on Periodontology. The same examiner evaluated the summative assessment for both the groups of students.

Statistical Analysis

The results were subjected to normality tests such as Kolmogorov-Smirnov and Shapiro-Wilks tests and the obtained data showed that they followed a parametric distribution. Independent t-test was performed to compare the average marks obtained in the summative assessment between the two

groups. All analyses were conducted using statistical software (SPSS software, version 17). $p < 0.05$ was considered to be statistically significant.

RESULTS

The academic performance (summative assessment) of both the groups of students from different academic timelines were compared using the independent t-test. The marks obtained from the written examination for the subject of Periodontology was significantly higher for the Group II students who were taught using the 'The Flipped Classroom' when compared to the Group I students taught using conventional lectures (p-value 0.000) [Table 2].

DISCUSSION

This retrospective study was conducted among undergraduate dental students in the subject of Periodontology employing the traditional and flipped classroom models of teaching. It was observed that the student's academic performance in the final exam was significantly better with the flipped classroom model. This result shows that technology has been a promising platform and its inculcation has significantly improved the efficient usage of student's time and their satisfaction. The didactic time was considerably reduced with more in-class activities and case-based discussion which had a positive impact on the student's performance in the final exam. A similar result was observed in a study conducted by Lee *et al.*, who showed a significant improvement in the student's performance in quizzes and their satisfaction in understanding the complex topic of Periodontal diagnosis and treatment planning (Lee C and Kim S-W 2018).

The students who get accustomed to conventional lectures may avoid the idea of a flipped classroom as the onus of learning is shifted to them (Roach T 2014). Their concerns include a rigorous workload, the uncertainty of success and potential classroom unsettledness (Lage M *et al.*, 2000; Sharma N *et al.*, 2015; Smith J 2013; Hughes H 2014). Even though there are many apprehensions, the flipped classroom has found its way in various disciplines and emerging as a game-changing teaching methodology in the field of education. For an equine science course, the students rated the flipped class experience to be 4.4 on a 5-point Likert scale whereas, for a neurology course, the students favored the flipped classroom for interaction and collaboration (Mortensen CJ 2015; Jung H 2018). Though the scales for assessing student satisfaction were not employed in this study, the faculty feedback on student's response in a flipped classroom was very enthusiastic.

The enrollment sizes should also be taken into consideration for course design. It should be taken into account that methods used in flipping smaller courses may not be feasible for larger classes, but certain studies maintain that the benefits of flipped classroom can be reaped for all course sizes (Mc Laughlin JE *et al.*, 2013; Deslauriers L *et al.*, 2011; Neville MW 2003). The use of team-based and group activities has been advocated for larger classrooms. It should be duly noted that in this study, the flipped classroom model also utilized group and team-based exercises to make the class more engaging and interesting. The various activities included Jigsaw, POGIL, Peer-led team-based learning, Critical thinking exercises and Case-based discussions.

The main strengths of this study were that four out of six-faculty taught the Periodontology course over the two academic timelines and the final exam was standardized with the same examiner for the summative assessment. Also, the difficulty level of the final exam question paper among the two groups could have been a potential confounding factor but this was alleviated because the University has a well-organized question bank with structured key points that was handed to the students at the beginning of their course. The limitations of the study include that it was carried out in one course (Periodontology) and in a single center. Future scope of research includes employing the flipped classroom model for various courses in the dental curriculum to gauge its effectiveness and student's perception towards the teaching methodology.

CONCLUSION

This study concluded that there was a significant difference in the student's academic performance (summative assessment) in the final Periodontology exam in favor of the 'The Flipped Classroom' model of teaching. As the classrooms of today continue to evolve and modernize, pedagogical techniques like the flipped classroom should be considered for lecture-style courses in the dental curriculum.

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