The flipped classroom in dental education - Learning beyond the four walls of the classroom

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Abstract

Introduction: The ‘Flipped Classroom’ is a technology based approach, where the traditional class time and self-study activities are reversed or ‘flipped’. In this model, low level cognitive skill like ‘knowledge acquisition’ are assigned to the students outside the classroom and activities that require higher cognitive skills like application and problem solving are done under the guidance of teacher in the classroom. We present a case study which was conducted at faculty of dentistry, Melaka Manipal Medical College to train year 3 dental students in prosthodontics using flipped model.

Methods: The study was conducted at Faculty of Dentistry, Melaka Manipal Medical College, for the year 3 BDS students. We created four short videos, each of 15 minutes’ duration, on the four cast partial denture topics. Reading materials and case examples were also provided to the students to go through before coming to class. For the classroom activity we chose real patient cases, with models and description. Students were asked to apply the principles and design a cast partial denture with justification to enhance critical thinking. Hands on experience on manipulation of impression materials was given to the students. We present a case study which was conducted at Faculty of Dentistry, Melaka-Manipal Medical College to train year 3 dental students in Prosthodontics using the flipped model.

Results: Student reflections were collected and four main themes were generated which were qualitatively analyzed. Students highlighted that there was flexibility in learning and could revisit lectures whenever needed. They liked that the classroom activities were interactive and promoted collaborative and peer learning.

Conclusion: The flipped classroom can enable students to be better prepared for the clinical experience and the teachers can expose them to problem solving and critical thinking components utilizing the teaching time allocated.
Keywords: Flipped Classroom, Learning tools, Technology based learning

Introduction

For more than a decade, health professions education has been experiencing a strong call for transformation (Hurtubise L, Hall E, Sheridan L and Han H 2015; Carraccio C et.al. 2002). The ubiquitous nature of technology today has led to the advent of technology enhanced learning and transformed educational technologies from esoteric legacy applications used by a few pioneering faculties to mainstream applications integral to the medical school educational enterprise (Robin BR 2011). Disruptive innovations including social networks, cloud-based computing, mobile devices, and video recording are enabling educators at all levels to flip their classrooms to meet the needs of the 21st century (Prober CG and Khan S, 2013).

Flipping the classroom, at its most fundamental level, is the practice of assigning learner’s didactic material, traditionally covered in lectures, to be learned before class while using classroom time for more interactive and active learning (Hurtubise L, Hall E, Sheridan L and Han H 2015).

Using a backward instructional design to plan learning activities, creating opportunities for pre-learning (eg: video recording of didactic materials, developing formative and diagnostic assessments to determine learning gaps, and using active learning strategies and technology to address the learning gaps and develop competency) are some of the mandatory steps for implementation of a flipped classroom (Han H, Resch DS and Kovach RA, 2013).

Additionally, we as medical educationists should be open to opportunities to develop longitudinal and inter-professional learning experiences, while being sensitive to the organizational change required to flip the classroom (Hurtubise L, Hall E, Sheridan L and Han H, 2015).

Differences between traditional method and flipped classroom (Brame C, 2017)

Using the blooms cognitive levels, we can understand that in a traditional classroom, the knowledge and understanding of the subject takes place in the classroom and is imparted to the students via a lecture. The higher domains of application, analysis and evaluation are expected to be achieved by the students outside the classroom as a part of their home assignments. (Figure 1 and Figure 2)
However, in a flipped model, the lower cognitive domains are acquired by the students outside the classroom and the actual teacher-student interaction time is utilized to train students to apply the learnt principles and allows to
incorporate higher order thinking skills in the students. (Figure 2 and Figure 3)

Figure 3

![Flipped model](image)

**Why flipped classroom**

The ‘Flipped Classroom’ is a technology based approach to teaching, apt to the millennial learners.

Advantages of this approach include (Williams D E, 2016; Hurtubise L, Hall E, Sheridan L and Han H, 2015; Goldberg H, 2014):

- More student centered approach
- An increase in student engagement and a shift from passive listening to active learning
- Increased interactive sessions between the teacher and the students creating better interpersonal relationship
- Opportunity for the learners to control the speed and bookmark sections, as well as review concepts before and after class
- Possibility for asynchronous learning and flexibility
- Archiving of teaching resources becomes possible
- Collaborative working between students
- Formative assessments can be incorporated during the interactive sessions to evaluate the development of multiple competencies and elicit learning gaps. Data on learning gaps enable teachers to mitigate the variance in learners’ competency and recommend self-directed instructional activities.
How does it work

Hurtubise L proposes in his article that the foundations of the flipped classroom lies in time-tested educational theories. According to the author, Dewey's Reflex Arc Concept, is the core principle governing the flipped model. In this theory, teaching and learning do not occur in a closed system where a teacher provides instruction (stimulus) and students simply absorb what they were told (response) in the classroom (Hurtubise L, Hall E, Sheridan L and Han H, 2015; Dewey J, 1896). Instead, learning experiences in this technique occur beyond the boundary of formal class time and place, and resemble a circular and organic relationship where all activities are connected and become meaningful and enriched by the previous experiences (Hurtubise L, Hall E, Sheridan L and Han H, 2015).

In this organic learning environment, learners become the owner of the learning process and can actively engage in "the iterative process of building mental models from existing and new information. They can test these models by identifying their learning gaps, seeking resources and assistance, and interpreting information based on their experiences for further development" (Hurtubise L, Hall E, Sheridan L and Han H, 2015).

Learners stay in the zone of proximal development where they manage their learning process metacognitively through reflection, and cognitively develop their own knowledge and skills with expert scaffolding and guidance on the side. Teachers' lectures, in-classroom activities, and out-of-classroom activities are designed as scaffolding units to facilitate student-centered enviroments. In flipped classroom, active learning is a mechanism for a student-centered, organic, collaborative learning environment (Hurtubise L, Hall E, Sheridan L and Han H, 2015).

Methods

Our experience in implementing flipped classroom for dental topics

At faculty of dentistry, Melaka Manipal medical college, Malaysia, we attempted to use the flipped model for the year 3 BDS students.

Pre- class assignment

The type of pre-work assigned is crucial to the success of the flipped classroom. Asking students to read a chapter or watch a video before coming to class is insufficient. The content needs to be engaging, to adhere to andragogical principles, and to cater to different types of learners. For example, visual and auditory learners should do well with video content, whereas reading/writing learners may prefer written notes. Kinesthetic learners may want to deal with problems and vignettes as preparation. Thus, a pre-work for all students cannot be a one-size-fits-all lecture either. Rather, a combination of reading and viewing material, questions, and cases are necessary to facilitate all learning strategies (Morgan, H. rt.al. 2015).

Keeping this in mind, we created four short videos, each of 15 minutes' duration, on the four cast partial denture topics namely Kennedys classification, components of cast partial dentures, indications and contraindications for cast partial dentures and special considerations for distal extension partial denture (Figure 4). Reading materials and case examples were also provided to the students to go through before coming for class.
Class- time activity

For the activities in the classroom, we chose real patient cases, with models and description of the cases (Figure 5). Students were divided into small groups and asked to apply the principles of classification, which they learnt online. Critical thinking and application skills were enhanced by asking students to choose an appropriate component based on the case given. They were asked to give justifications why they chose a cast partial denture for a particular case to enhance their analytical skills. Each group was given an opportunity to present their findings and give rationale for their choices. The students were given hands on experience to manipulate elastomeric impression materials, which they used on simulated models to practice impression techniques.

Figure 5
Assessment

The advantage of flipping the classroom is to create an opportunity for the teacher to convert the classroom time into interactive learning sessions. These active learning strategies are formative assessment tools for reinforcing learning, for gauging students understanding of the topic and are in short assessments for learning.

Once the student discussions and presentations were completed, we conducted a formative assessment in the form of a four-corner game. This game is a great way to encourage dynamic movement while students answer multiple-choice questions. We designated each corner of the classroom to represent A, B, C, and D. Students moved to the corner that they believe corresponds with the correct answer. Students were asked to justify their corner choices and instant feedback was given to clarify their misconceptions if any.

At the end of the session student reflections were collected on their experience and perception regarding the flipped classroom. The students enjoyed the flexibility they had in watching the online videos and resources. They had the opportunity to watch the videos as many number of times as needed and could revise the subject before and after the class. They thoroughly enjoyed the interactive sessions in the classroom and felt they had the opportunity to apply their knowledge to solve the cases. The students enjoyed collaborative learning in the small groups and learnt from each other, which was not feasible to do in a traditional lecture. The game based formative assessment was much appreciated by them as a tool, which enhanced fun while learning.

The proposal was approved by the Dean of the institution. As there were no ethical issues identified, it was exempted from the same. Student consent was obtained for using pictures in this article.
Discussion

The strengths of the flipped classroom are best illustrated by considering the alternative. In the traditional education model, students come to the lecture hall without preparation. The lecturer gives a one-size-fits-all lecture from start to finish. Upon completion, every student has a question, but each is different. Along the way, each student turned to some distraction and missed an element of the lecture. This model has no interaction, teamwork, leadership, technology, or thought on how to maintain lifelong learning (Williams D E 2015). Due to the constraint of time, many a times the lecturer does incorporate any formative assessment strategies, which are the most important components for learning.

However, with the flipped model, students watch a lecture in an environment of their choice at their own pace. Students can review the concepts they do not understand as needed. They then come together to drive beyond the basics to develop skills that cannot be taught in a lecture.

Technology is making this learning model possible, scalable, and customizable. Material can be offered, fitting the busy schedules of adult learners juggling clinical and classroom expectations. The best educators, once constrained to a classroom of a few hundred, can now reach thousands of students. Platforms can offer multiple learning modalities in one location (Williams D E, 2015).

As with every method, the flipped model also has certain limitations (Aydin B and Demirer V, 2016; Rivera, E, 2015; Herreid, C. F. and Schiller, N. A. 2013; Effield, J, 2013; Ash, K, 2012).

- learners who adopted traditional education may resist this new model
- The need to invest time and resources to develop courses
- The possible need to be technologically competent and trained
- Time needed for both teachers and students to adapt and acquire the new skills required for this more active and self-directed approach to learning.
- Teachers can be suspicious about whether the students are watching the videos or not and may find interaction during the individual learning processes insufficient.
- Misuse of the flipped model

Conclusion

To accomplish our attempt to train students to learn essential medical or dental knowledge and build skills and abilities beyond information recall, the flipped classroom represents a promising modality in medical education. This model represents a potential future as a means for improved instructional efficiency. However, to effectively implement this model, we need to be cognizant of overall curricular goals, the underlying theories of education, the active learning strategies and the development of new education technologies. To fully realize the potential of the flipped classroom, significant change in management strategies including faculty training are needed so that this technique can be used judiciously.

Take Home Messages
Notes On Contributors

Prof. Dr. Prashanti Eachempati: Principal investigator and primary author for manuscript preparation.

Assoc. Prof. Dr. Kiran Kumar KS: Co-Investigator and co-author for manuscript preparation.

Prof. Dr. Abdul Rashid Hj Ismail: Guidance during the conduct of the study.

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Appendices

Declaration of Interest

The author has declared that there are no conflicts of interest.