



Changing the Landscape of Learning in Dentistry

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Abstract

At the University of British Columbia Dental School we are using Flipped Learning to teach fundamental medical sciences to our first year students. The journey to a flipped curriculum at the UBC Dental School was long overdue, and yet for some, came far too fast. There was and is, significant Faculty opposition, but our research is showing the benefits of flipped learning vs. the traditional curriculum. Using tools like Peer Wise and UBC's award winning Progress Survey has provided a superior learning environment.

The purpose of the study is to assess the effectiveness of a flipped learning (active) curriculum versus the traditional lecture based (passive) curriculum in a first year Dental fundamental medical sciences course.

Keywords: Flipped classroom; Traditional lecture; Fundamental medical sciences; Dental curriculum

Introduction

“Education is what survives after what was learned has been forgotten” Professor BF Skinner. Education is undergoing a transformation thanks to the availability and integration of technology. A “flipped” or “blended” classroom is an instructional strategy that uses technological innovation to maximize the teacher-student interactions during lecture time. Flipped classrooms reverse the traditional learning environment by delivering instructional content outside of the classroom and moving activities, including those that may have traditionally been considered homework, into the classroom. This is done by creating online lecture videos of course content for the students to watch at home before class [1]. This “pre-loading” of educational content allows for increased levels of active learning and higher order thinking during lecture time. This frees up lecture time for the students to actively engage in concepts in the classroom with the guidance of a mentor/teacher. The flipped classroom intentionally shifts instruction to a learner-centered model in which lectures explore topics in greater depth and create more meaningful learning opportunities. We have started a study at the University of British Columbia Dental School to determine the impact on student performance of “flipping” the curriculum.

Flipped classrooms have been introduced at all educational levels (Kindergarten to University) and are implemented in many different ways. The main difference between a flipped classroom and a traditional classroom is the incorporation of active learning techniques during class, and content delivery happening outside of class. The content delivery may take a variety of forms. Usually video lectures prepared by the instructor or third parties are used to deliver content, although online collaborative discussions, digital research, and text readings may be used. There has been a significant jump in the volume of educational videos available online over the last 15 years. YouTube, podcasts, the Khan Academy and other services make the implementation of a flipped/blended curriculum easier, and cheaper, than ever [2]. Pre-loading the students with their lecture material also allows them to learn at their own pace. Lecture videos can be re-watched until students better grasp a concept. The Flipped model also allows students to ask more informed questions in class and gives them the time to cover concepts in greater depth.

Flipped Learning allows class time to implement active-learning strategies and techniques. This allows students to assess and apply their knowledge with the guidance of the instructor.

Flipped curriculums also redefine in-class activities. Some of the active learning techniques include (but are not limited to):

1. Problem solving cases
2. Small group learning

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3. Mini-case studies
4. Videos
5. Role playing exercises
6. Clinical recreations
7. Jigsaw/expert groups
8. Test Based Learning
 - a. Fill-in-the-blank exercises
 - b. Anatomy mapping
 - c. Multiple choice questions (MCQs)
 - d. Quizzes
9. Original document analysis
10. Student presentations
11. Lab work
12. Debates
13. Peer review
14. Current event discussions

The students develop and improve their critical thinking and problem solving skills through these hands-on, interactive, and collaborative activities.

The flipped classroom allows more personalized interaction between the teacher and the students. With a less didactic approach, the students are more actively engaged in knowledge acquisition. The flipped classroom empowers the students to take more control over their learning. Studies show that student understanding is improved when students are actively engaged in the learning process. Existing research demonstrates the importance of implementing active-learning strategies within post-secondary STEM classrooms [3].

The UBC Dental Fundamental Medical Sciences (FMS) course constitutes 40% of the First Year curriculum. FMS is 19 hours of class time per week- out of a total 32 hours of class/clinical time per week. The FMS curriculum is broken down into 5 body systems blocks (Gastrointestinal, Blood, Lymphatics & Immunology, Cardiovascular, Pulmonary, and Renal) with each body system block covering 4-5 weeks. Each block follows the same monthly format, as shown below:

Monthly curriculum format

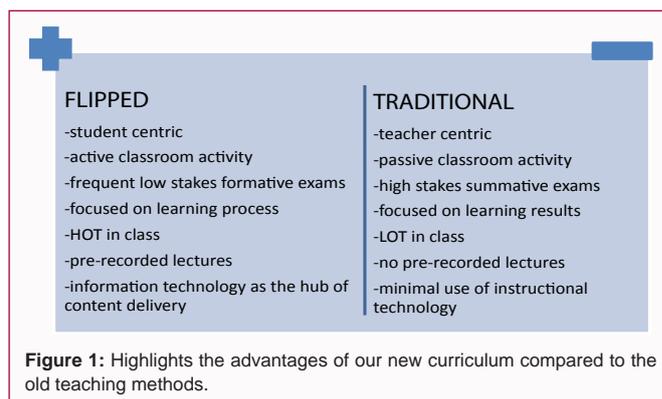
Week 1- 2 session PBL case, I Clicker Quiz, Lectures + DALEs

Week 2- 2 session PBL case, I Clicker Quiz, Lectures + Debate Styled DALEs

Week 3- 2 session PBL case, Take Home Assignment Due, Student Presentations

Week 4- 2 session PBL case, I Clicker Quiz, Lectures + DALEs, End of Block Exam

The lectures are limited to 10-15 minute per lecture. They are interspersed throughout the class time, broken up with small group learning exercises using the in-class activities listed previously. PBL's are Problem Based Learning dental cases that the students work through in groups of 8 aided by a Tutor. DALEs are Dental Applied Learning Experiences- dentally based CBLs (Case Based Learning)



exercises that the students complete in groups of 5, aided by a Tutor.

Holding weekly quizzes ensures the students are viewing/reading the lecture materials at home. Holding monthly exams ensures the students are staying current with the material. These frequent, low-stakes exams are designed to keep the students engaged throughout the curriculum. The information being taught- the medical aspects of dentistry- are too vital to their careers, and to the safety of their patients- to be covered in one 80% final exam that the students “cram” for.

Throughout the curriculum we focus on the “SMART” learning tenants that are at the core of the Flipped Learning pedagogy:

SMART learning

S = Self-directed

M = Motivated

A = Adaptive

R = Resource-enriched

T = Technology-embedded

Why did we transform the curriculum from a traditional, lecture based approach to an innovative, flipped/blended approach? Chart 1 highlights the advantages of our new curriculum compared to the old teaching methods.

The innovative, flipped/blended approach also:

- Increases student engagement
- Strengthens team-based skills
- Offers personalized student guidance
- Focuses classroom discussion

Challenges

- Access to videos may be limited for some students
- Videos are very time consuming to create for the educator
- Some students will still prefer face-to-face lectures
- Educators must be organized and prepared to answer more informed questions

- In class activities must motivate students to watch videos

Advantages

- Hands-on, collaborative activities in class

- Students can listen to lectures over and over for self-directed learning
- Technology incorporated into the curriculum to aid learning and retention
- Students take responsibility for their learning
- Instructors able to be tutors instead of non-interactive lecturers

The body of current research hasn't definitively shown which learning method (active *vs.* passive) is superior. The majority of existing research is either anecdotal or contains non-comparative data collected from a short course with a relatively small sample size [4]. The most quoted study in support of flipped learning demonstrated statistically significant gains in a physics class from a comparative study [5], but the positive results in support of the flipped model weren't conclusively due to this teaching method.

More research is necessary to establish best practices in education. Using an Action Research Model we have designed a study to achieve that goal. We aim to add research to the existing literature about the innovative, flipped/blended classroom approach that is longitudinal, directly comparative to the same subject matter taught in a traditional model, and specific to dental education.

Research Question

The purpose of this longitudinal study is to assess the effectiveness of a flipped learning (active) curriculum versus the traditional lecture based (passive) curriculum in a first year Dental fundamental medical sciences class.

Methodology

The current study was conducted at the University of British Columbia, a comprehensive, urban, public research university in Vancouver, BC. UBC was founded in 1908 and currently serves a growing student population of approximately 61,113 total students. The current study encompasses students from the Faculty of Dentistry at UBC.

First Year Dental Students (n = 47 + 60) enrolled in a Flipped/Blended (active) Fundamental Medical Sciences Course were evaluated for their performance compared to previous classes of First Year Dental Students (n = 350) enrolled in a traditional, lecture-based (passive) curriculum.

We establish the baseline student performance using multiple data sources, including but not limited to:

- Existing archival test data within the school
- Surveys and questionnaires
- Test results
- Interviews

We have 7 years of historical multiple choice question (MCQ) data on over 300 MCQs used in both the old (traditional, lecture based) and new (flipped/blended) curriculum. The initial assessment of this question bank shows the flipped curriculum students performing 11% better on these questions. This is a small sample size, and there are many different factors at play but it is encouraging. The improved performance could be attributable to:

- The flipped delivery

- Increased testing frequency
- Weekly in-class quizzes
- Monthly Block exams
- Weekly homework assignments
- Monthly student presentations
- More dentally centric teaching

UBC Dentistry also has the Progress Survey, which is a three-hour long test with 200 multiple choice questions that sample all areas of dental cognitive knowledge. Students are assessed on the expected competencies of a new graduate dentist. All students in the Dental Program take this test twice a year- at the beginning and the end of each school year. The results generate a Personal Progress Index (PPI) to evaluate their performance relative to standard benchmarks and their peer group.

The Progress Survey results from the first year (flipped) class were very low (as expected) when they took the exam during their first week of dental school. Their Progress Survey results (using a different pool of 200 MCQs) were significantly better when they took the exam at the end of their first year (as expected). The most interesting Progress Survey data analysis was the comparison of the second year class (traditional curriculum) *vs.* the first year class (flipped). In the September exam the second years did significantly better than the first years (as expected). However, in the May Progress Survey exam the first year dental students had a better average grade than the second year dental class. This was very surprising and very encouraging. Again it is a very small sample size but students with 10 months of a flipped dental curriculum outperforming students with 20 months of a traditional dental curriculum is exciting and encouraging.

In addition to the quantitative study we are also conducting a qualitative analysis of the new curriculum. At present there doesn't exist a published, validated tool to assess the student's perceptions of a flipped/blended curriculum. There is however a number of non-validated instruments that have been used [6].

We have designed an online student questionnaire with the following questions:

- Found the pre-reading material useful
- Consistently read the pre-reading material
- Found the pre-class video material useful
- Consistently watched the pre-class video material
- Re-read the pre-class material for exam review
- Re-watched the pre-class material for exam review
- Compared with other courses the pre-class material was useful
- I Clicker quizzes motivated pre-class preparation
- I Clicker quiz reviews were a good learning tool
- Course format allowed for a better understanding of concepts
- Initial impression of course format
- Post Course impression of format

We are also holding small group round table discussions assessing the student's impressions of the flipped curriculum. These will be held at the beginning of the school year (to examine preconceptions of a flipped classroom) and the end of the school year.

In past years one of the most common requests from students is a more dentally relevant curriculum. In this study we will utilize a relevancy integration survey to determine what the students specifically prefer and whether or not the new curriculum provides it. The data will be reported as means +/- SE. Statistical comparisons will be performed using an unpaired t-test and Pearson correlation analysis.

Conclusion

At UBC Dental School we are achieving enduring understanding through Flipped Learning. We are promoting deeper learning and encouraging students to take greater responsibility for their own learning. With Flipped Learning we have less transmission, and more synthesis and absorption of knowledge. Why Flipped learning... because the world doesn't need memorizers, it needs critical thinkers and problem solvers.

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