

FLIPPED CLASSROOM EXPERIENCE IN CALCULUS COURSES AT MEF UNIVERSITY

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1. FLIPPED LEARNING AND FLIPPED CLASSROOM

Flipped Learning is a pedagogical approach in which **direct instruction** move from the **group learning space** to the **individual learning space**, and **the resulting group space** is transformed into a **dynamic, interactive learning environment** where the educator guides students as they apply concepts and engage creatively in the subject matter.

The **flipped classroom** is a pedagogical model in which the typical **lecture and homework elements of a course are reversed**. Short video lectures are viewed by students at home before the class session, while in-class time is devoted to exercises, projects, or discussions.

A Planning Model for Flipped Classes



2. FLIPPED CLASSROOM EXPERIENCE OF CALCULUS COURSES AT MEF

Course Design:

- Syllabus prepared according to ABET/MÜDEK accreditation scheme and Flipped Classroom technique
- Course content partitioned among 13 or 14 weeks together with course assessment means
- Course assessment percentage **including Flipped Learning percentage** are identified in accordance with course learning outcomes and program (student) outcomes
- **Flipped Classroom task and out-of-class activities before class** identified and assessed
- **In-class activities** identified and assessed
- **Out-of-class activities after class** identified and assessed

Calculus I (Fall 2014)

Flipped Classroom Percentage (to Overall Grade): 10%

Number of sections: 2

Number of students in each section:

19 students in Section 1

18 students in Section 2

Approximate time for out-class activities before class:

Half an Hour to One Hour

Time for in-class activities:

Meeting twice a week for eighty minutes in each section

Approximate time for out-of-class activities after class:

None

Introduction of Task and Out-of-Class Activities before class:

- Power point presentations and videos, not exceeding 15 minutes, of topics to be covered in each week are prepared and uploaded into Blackboard prior to the scheduled class.
- Further problems for topics covered are on voluntary basis
- No grading for out-of class activities before class

In-Class Activities

- Grouping students into groups of two and three at random each class
- Assigning unique selected problems to each group
- Class participation assessed by attendance on 0 (**absent student**) and 1 (**attending student**) basis

Out-of-Class Activities after class:

- None

Calculus II in Spring 2015

Flipped Classroom Percentage (to Overall Grade): 5%

Number of sections: 1

Number of students in each section:

32 students

Approximate time for out-class activities before class:

Half an Hour to One Hour

Time for in-class activities:

Meeting twice a week for eighty minutes in each section

Approximate time for out-of-class activities after class:

None

Introduction of Task and Out-of-Class Activities before class:

- Power point presentations and videos, **not exceeding 10 minutes**, of topics to be covered in each week are prepared and uploaded into Blackboard prior to the scheduled class.
- Further problems for topics covered are assigned on voluntary basis
- No grading for out-of-class activities before class.

In-Class Activities

- Grouping students into groups of three or four at random each class.
- Assigning unique selected problems to each group
- Flipped Classroom Practice assessed by pop-up quizzes on 0 (absent student), 1 (attending student in poor performing group) and 2 (attending student in poor performing group) basis.

Out-of-Class Activities after class:

- None

Calculus I (Fall 2015)

Flipped Classroom Percentage (to Overall Grade): 20%

Number of sections: 4

Number of students in each section:

Section 1: 36 students ; Section 2: 40 students

Section 3: 39 students ; Section 4: 38 students

Approximate time for out-class activities before class:

Half an Hour to One Hour

Time for in-class activities:

Meeting twice a week for eighty minutes in each section

Approximate time for out-of-class activities after class:

None

Introduction of Task and Out-of-Class Activities before class:

- Power point presentations and videos, **not exceeding 10 minutes**, of topics to be covered in each week are prepared and uploaded into Blackboard prior to the scheduled class.
- Further problems for topics covered are assigned on voluntary basis
- Introduction of Discussion Board on Blackboard
- Bonus points given to Discussion Board Participation.
(extra max 4%)

In-Class Activities

- Grouping students into groups of three or four at random each class.
- Assigning unique selected problems to each group in every section
- Flipped Classroom Practice assessed by pop-up quizzes on 0 (absent student), 1 (attending student in poor performing group) and 2 (attending student in poor performing group) basis.

Out-of-Class Activities after class:

- None

3. LESSONS LEARNED

- Increasing the percentage of the Flipped Classroom Practice grade in the total course grade increases the rate of success of the students and of the course.
- Partitioning the contribution of the out-of-class and in-class activities in Flipped Learning is needed. The assessment of in-class activities by pop-up quizzes seems to work, but slows down the pace of progress in topics covered. The remedy can be to start the solution and outline the method of solution in class, and complete the solution outside class as an assignment for out-of-class after class activities.

- To promote the out-of-class activities before class, the use of the Discussion Board for each video should be encouraged, if necessary, through assigned homework problems.
- For service courses with large number of students a blended teaching approach can be used to decrease the number of sections to help space and staff economy.
- More efficient use of the software and communication means should be developed to remedy the load of the instructor.

4. FUTURE PERSPECTIVES

A) FLIPPING LAB EXPERIENCE

Kevin Revell, Murray State University

Organic Laboratory II (3 US credits)

Challenge : **Optimizing the pre-lab discussions.**

If we talk about lab a week beforehand, students often forget the key details by the time the lab arrives. On the other hand, if I we discuss immediately before lab, students tend to be much less prepared. Either way, they spend far too much time figuring out what's going on. **This year, I decided to flip the prelabs.**

Each week, I made a short video overview of the experiment, featuring key ideas, reactions, mechanisms, safety, and technique.

I made the videos available about 24 hours before the start of lab, and then included a prelab quiz which was due by the start of lab. The quizzing can be done using the LMS (both Blackboard and Canvas offer quizzing), or through an online homework system – an especially handy option for labs which are integrated with the course. The results for this class were terrific. I freed up more of the pre-lab classroom time for spectroscopy, multistep synthesis, and literature techniques, and, as a result, I was able to go deeper with this group than I ever have before. And I could see a huge difference once we stepped into the lab: Students know what they were doing, and hit the lab ready to go.

B) FLIPPING DESIGN & PROJECT COURSES

Dan Frey and Amy Smith, MIT

.Elements of Mechanical Design
Course Introduction

Bloom's Taxonomy of Educational Objectives

Associated Action Verbs

6. Synthesis	Design, invent, propose
5. Evaluation	Judge, critique, justify
4. Analysis	Predict, model, derive
3. Application	Calculate, solve
2. Comprehension	Explain, paraphrase
1. Knowledge	List, recite

Time Required

This subject is 12 units: 3-3-6

- 3 hours of “lectures”
- 3 hours of lab
- 6 hours outside of scheduled class time
 - Reading ahead / studying for exams
 - Doing homework
 - Doing your projects

Collaboration

- We encourage you to work together and learn from one another
- What you submit should be your own work
- Acknowledge the contribution of others
- The course policy handout lays out many examples:

After working an assignment independently, you compare responses with another student which alerts you to an error in your own work which you then correct. You should state at the end of your submission that you corrected your error on the basis of checking responses with the other student. No credit will be lost if the response is correct, the acknowledgment is made, and no direct copying of the other response is involved