

Observations on Using the Flipped Classroom Model in an Introduction to Environmental Engineering Course

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Objectives

- Implement the Flipped classroom model in a sophomore-level environmental engineering course to see how students would respond to it.
- Allow students to work at their own pace and at their leisure outside of the classroom.
- Class time would be used for answering questions and allowing teams of students to complete assignments; primarily problem solving activities.

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What is Classroom Flipping?

- Swartz et al. state that “**Classroom flipping is a time management strategy**

that creates opportunities to incorporate the methods commonly thought to promote

self-directed learning skills,
creative thinking and problem solving,
and **team building exercises**”.

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Why Use Flipping?

- Combines several teaching methods, e.g. student-centered learning, problem-based learning, peer assisted learning, and constructivism.
- Increase the amount of material in a course while addressing breadth and depth issues.
- Holds students accountable for learning.
- Provides collaborative and cooperative learning to occur in class.
- In-class time can be used to respond to questions and explain difficult concepts.

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My Flipped Classroom

1. **25 WebEx lectures** recorded averaging 38 minutes each.
2. **21 assignments** were completed during the semester; **four** of which were completed **on-line but reworked in class**.
3. **17 assignments** completed in **teams** of 2 or 3 students during class.

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Methods

- **Pre- and post-surveys** were administered during F2015 (performed anonymously).
- Students were asked to select their **preferred classroom approach to teaching** and **their experience with** the Flipped Classroom.
- **15 questions** used by Kecskemety and Morin were rated on a 1 to 5 Likert scale. 1=strongly disagree; 5=strongly agree
- **4 other questions** posed to get feedback.
- **Mann-Whitney U test** performed at $\alpha=0.05$

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Students Asked to Select Their Preferred Approach to Teaching & Experience with Flipped Classroom

Traditional Lecture - Based Classroom Approach

Partially traditional and partially flipped

Flipped or inverted classroom

Have you experienced the flipped or inverted classroom before?

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15 Questions: The flipped classroom approach....

1. Lets me get immediate feedback while working on HW and activities.
2. Does not use class time efficiently.
3. Lets my instructor focus primarily on topics that are more difficult to understand.
4. Do not make good use of technology.
5. Makes class time more engaging.
6. Creates an active learning environment.
7. Helps me to learn topics to a deeper level than a traditional classroom.

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Questions: The flipped classroom approach....

8. Accommodates my learning style.
9. Personalizes learning to me.
10. Does not allow me to learn at my own pace.
11. Helps me because I can revisit the preparation material whenever I need.
12. Makes me feel more responsible for my own leaning.
13. Helps me become a better self-learner.
14. Does not encourage me to learn from peers.
15. Grows my life-long learning skills.

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Additional Questions/Comments

1. Did you take other courses this semester using the Flipped classroom pedagogy? List the course #.
2. Do you believe that a Flipped classroom enhanced your learning experience? Why or why not?
3. Have you used WebEx in any of your previous courses? If so, did you like or dislike using it? If you have not used it, do you have anxiety or other concerns about using it?
4. Any other comments that you wish to share about the semester?

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Results

Preferred Classroom Approach	Pre-Survey	Post-Survey
Traditional lecture-based classroom	44.4%	37.5%
Partially traditional and partially flipped	55.5%	62.5
Flipped or inverted classroom	0%	0%

Experience with Flipped Classroom	Pre-Survey	Post-Survey
	16.7%	50%

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Mann-Whitney U Test

Question	U	$U_{critical}$	Accept or Reject H_0
1	27.5	20	Accept
2	34.5	20	Accept
3	37.5	20	Accept
4	39.5	20	Accept
5	40.0	20	Accept
6	43.0	20	Accept
7	45.0	20	Accept
8	38.5	20	Accept
9	40.0	20	Accept
10	30.0	20	Accept
11	34.0	20	Accept
12	36.0	20	Accept
13	34.0	20	Accept
14	24.5	20	Accept
15	38.5	20	Accept

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Question #1

- View of getting immediate feedback while working on homework and other activities.
- Results from the surveys indicated that students went from a **slightly disagreeable (2.66)** to a **slightly agreeable (3.60) view.**

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Question #6

- Students were relatively **neutral** regarding **creating an active learning environment.**
- The average response went from a **3.11** to **3.00** on the pre and post-surveys.
- Students worked in small teams to complete assignments in addition to getting direct help from the instructor.
Shouldn't this create active learning?

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Question #8

- Student responses indicated that they **disagree** with the notion that the “Flipped” classroom **accommodates their learning style.**
- Average score on the pre-and post-survey was **2.66** and **2.30**, respectively.
- Many students do not accept the responsibility of student-centered learning.

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Question #13

- Students indicated that the “Flipped” classroom **helped them to become a better self-directed learner.**
- The average response was **3.00** and **3.60** on the pre- and post-surveys.
- An underlying objective of the course was to make **students self-learners** so that they would be able to survive the rigors of upper-level engineering courses.

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Do you believe that a Flipped Classroom enhanced your learning experience?

- **4 of 9** students answered that it would enhance their learning experience on the **pre-survey**.
- **3 of 10** students believed it enhanced their learning on the **post-survey**.
- One student indicated that it was a different experience and would be useful in future courses.

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Have you used WebEx in your previous courses? Like or dislike?

- There were mixed responses about using WebEx. The consensus was fairly neutral to using it.
- Most students stated that "It was okay or it worked pretty well."
- Some students disliked it because they "preferred a traditional lecture versus an on-line lecture".

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Other comments you wish to share about the semester?

- "Even if my professor next semester does not use the Flipped classroom, I will go into the upcoming semester more self-motivated and with a better ability of self-learning".
- "I do not like the Flipped classroom. I felt like it had a negative impact on the material that I learned and the grades that I received this semester".
- "Flipped classroom allows more student interaction and preparation outside of class".
- "I need concepts reiterated a few times in different ways to comprehend the information".

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Conclusions I

- The Flipped classroom was successfully implemented in a sophomore, Introduction to Environmental Engineering class, to determine how students would respond to this pedagogical approach.
- On the final survey:
 - **0** students selected the Flipped classroom approach.
 - **62.5%** of students selected partially traditional lecture and partially Flipped.
 - **37.5%** selected traditional lecture.

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Conclusions II

- Mann-Whitney U statistical analysis indicated there was no significant difference in responses. Lack of statistical, significance primarily resulted from small sample size.
- There were mixed responses to the 4 additional questions posed to the students.
- The study was useful for learning about student perceptions on Flipping a classroom.
- The Flipped classroom approach was not accepted by this group of students.

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Author's Comments

- When used again, recorded lectures should be made shorter, 20-25 minutes.
- Implement in a larger class of students.
- Include more on-line assignments that could be re-worked in-class.
- Utilize the flipped approach in an upper-level or graduate class.

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Thank you very much!

Comments or questions?

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