Flipped Classroom

Overview:

Instructors across disciplines have looked for ways to promote long lasting student learning and for approaches that lead to more effective teaching and learning experiences in higher education (Bligh, 2000). One such tactics involves students completing outside-class reading, assignments, and understanding of key content, so instructors can make use of class time in activities that demand the application and deep understanding of the content matter learned by students before class. In other words, content coverage is moved outside the classroom in order to employ in-class time stimulating the upper levels of Bloom's taxonomy of cognitive skills (Anderson, Krathwohl & Bloom, 2001; Bloom & Krathwohl, 1984).

This teaching method has a long history of implementation in the humanities as students are frequently tasked with reading texts that will prepare them for in-class discussions and other active learning activities. However, across institutions and disciplines, it has received different tiles that include: Just-in-Time-Teaching (e.g., Novak et al, 1999); inverted classroom (e.g., Gannod, Burge, & Helmick, 2008; Strayer, 2012); flipped classroom (e.g., Jensen, Kummer, & Godoy, 2015; Smith, 2013; Wilson, 2013); backwards classroom (e.g., Schaffhauser, 2011); flipped teaching (e.g., Teo, Tan, Yan, Teo & Yeo, 2014) and reverse teaching (e.g., Foertsch, Strikwerda, & Litzkow, 2002). We will refer to this teaching and learning method as "flipped classroom".

The following sections offer a summary of what researchers and instructors across disciplines have reported around the implementation of a flipped classroom in different university-level teaching and learning contexts.

Courses & student enrolment:

Instructors have flipped their classrooms in varied topics that include, but are not restricted to, STEM disciplines (engineering, chemistry, calculus, statistics); the arts (visual arts); information systems and computer sciences; architecture; economics; and pharmacy. Reported flipped courses range from 100 to 400 level, mandatory, prerequisite, capstone, or specialization courses. Enrolments also fluctuate between low (20 students) to high (500+ students) and anything in between.

Pre class activities:

- Assigned/targeted readings
- Participation in blogs, forums, etc.
- Problem solving/worksheets
- Quiz prep questions
- Tutorials
- Video lectures/screencasts/video podcasts, content
- Video lectures/screencasts/video podcasts, practice/labs

In class active learning:

- Clinical cases
- Discussion/reflection
- Experiments/demonstrations
- Inquiry learning
- Peer assessment/instruction
- Problem solving/worksheets
- Programming/software use
- Quizzes/exams/concept inventories
- Review questions
- Team/group work

Evidence of impact:

The following are some of the benefits and limitations reported in the flipped classroom literature.

Benefits of a flipped classroom:

- Anytime/multiple access to materials
- Better performance in test/quizzes/homework
- Better time management
- Enhanced collaboration skills
- Enhanced communication skills
- Existing resources that can be adopted
- Facilitation of problem solving strategies/skills
- Improved understanding of new concepts
- Increased knowledge retention of material
- Increased motivation/engagement towards learning
- Increased practice time
- Increased self-efficacy
- Increased student-instructor interactions
- Larger content coverage
- More opportunities to receive feedback
- Reduced anxiety towards new challenges
- Self-regulated pace/independent learning
- Support of multiple learning/instructional preferences

Limitations of a flipped classroom:

- Greater upfront investment for development of resources (e.g., targeted reading, videos, etc.)
- Higher set-up cost
- Increased requirement for self-discipline
- Increased student workload
- Limited opportunity to ask questions during pre-class activities
- Reduced motivation/engagement in class
- Technology challenges (e.g., videos not complete/with errors; not working)

Vignettes:

"Students developed a better understanding of the theory underlining the procedures and experienced less anxiety about the complex practical steps and setup, and subsequently, improved work efficiency". (Teo, Tan, Yan, Teo & Yeo, 2014).

"The approach takes advantage of the benefits of both collaborative learning and distance learning while at the same time targeting the millennial student". (Gannod, Burge, & Helmick, 2008)

"There is some evidence that students learning via a flipping pedagogy outperform students who are in a traditional lecture". (McGivney-Burelle & Xue, 2013)

"Students' performance on the final examination significantly improved compared to performance of students the previous year who completed the same module in a traditional classroom setting". (Pierce & Fox, 2012)

"Students in the inverted classroom were less satisfied with how the classroom structure oriented them to the learning tasks in the course, but they became more open to cooperative learning and innovative teaching methods". (Strayer 2012)

References and Resources:

Aiken, J. M., Lin, S. Y., Douglas, S. S., Greco, E. F., Thoms, B. D., Caballero, M. D., & Schatz, M. F. (2014). Student use of a single lecture video in a flipped introductory mechanics course. *Physics Education Research Conference Proceedings*. Retrieved from http://arxiv.org/ftp/arxiv/papers/1407/1407.2620.pdf

Anderson, L. W., Krathwohl, D. R., & Bloom, B. S. (2001). *A taxonomy for learning, teaching, and assessing: A revision of Bloom's taxonomy of educational objectives*. Allyn & Bacon.

Bloom, B. S., & Krathwohl, D. R. (1984). *Taxonomy of educational objectives book 1: Cognitive domain.* Addison Wesley Publishing Company.

Connor, K. A. (2014). Flipping a classroom: A continual process of refinement. *Conference of the American Society for Engineering Education*. Retrieved from http://www.asee.org/file_server/papers/attachment/file/0004/4535/ASEE_Flipped_Process_v3.pdf

Davis R. S., Dean D. L. & Ball N. (2013). Flipping the classroom and instructional technology integration in a college level information systems spreadsheet course. *Educational Technology Research and Development*, 61(4), 563–580.

Enfield, J. (2013). Looking at the impact of the flipped classroom model of instruction on undergraduate multimedia students at CSUN. *TechTrends*, 57(6), 14-27.

Foertsch J., Moses G., Strikwerda J. & Litzkow M., (2002). Reversing the lecture/homework paradigm using eTEACHs web-based streaming video software. *Journal of Engineering Education*, 91(3), 267–274.

Gannod G. C., Burge J. E. & Helmick M. T., (2008). Using the inverted classroom to teach software engineering. *Proceedings of the 30th International Conference on Software Engineering*, Retrieved from http://sc.lib.muohio.edu/bitstream/handle/2374.MIA/206/fulltext.pdf.

Jensen, J. L., Kummer, T. A., & Godoy, P. D. D. M. (2015). Improvements from a Flipped Classroom May Simply Be the Fruits of Active Learning. *CBE-Life Sciences Education*, 14(1), ar5.

Lage M. J., Platt G. & Treglia M., (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *Journal of Economic Education*, 31, 30–43.

Leicht, R. M., Zappe, S., Messner, J. I., & Litzinger, T. (2012). Employing the classroom flip to move "lecture" out of the classroom. *Journal of Applications and Practices in Engineering Education*, 3(1), 19-31.

McGivney-Burelle J. & Xue F., (2013). Flipping calculus, *PRIMUS*, 23, 477–486.

Pierce R. and Fox J., (2012). Vodcast and active-learning exercises in a ''flip classroom'' model of a renal pharmacotherapy module. *American Journal of Pharmaceutical Education*, 76(10), 196–201.

Schaffhauser, D. (2011). The backwards class. *The Journal*.

Smith J. D., (2013). Student attitudes towards flipping the general chemistry classroom. *Chemistry Education Research and Practice*, 14, 607–614.

Strayer J. F., (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environment Research*, 15, 171–193.

Teo, T. W., Tan, K. C. D., Yan, Y. K., Teo, Y. C., & Yeo, L. W. (2014). How flip teaching supports undergraduate chemistry laboratory learning. *Chemistry Education Research and Practice*, 15(4), 550-567.

Wilson S. G., (2013). The flip classroom: A method to address the challenges of an undergraduate statistics course. *Teaching of Psychology*, 00(0), 1–7.