FLIPPING A CLASS: THE LEARN BY DOING METHOD

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Abstract:

Two major advantages of the flipped classroom format are it allows for greater flexibility in the use of class time and enhances the quality and quantity of one-on-one teaching encounters between faculty and students. There are as many varieties of the flipped format as there are educators using it, so experience varies from classroom to classroom. What is important is the format should emphasize active learning on the part of the students, empowering them to take responsibility for the learning process. The teacher's role becomes one of facilitator or coach.

Introduction

"Jesuits learn best by teaching others."

− Father Juan Polanco, SJ (1517-1576)[1]

What's true of the Jesuits is true of all teachers, and their students. Learning by teaching others is the heart of the flipped learning (or inverted classroom) method.

A useful definition of "flipped learning" has been developed by the Flipped Learning Network (FLN):

> Flipped learning is a pedagogical approach in which direct instruction moves 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.[2]

The essence of the flipped classroom is the transformation of the relationship between the educator and the students. Flipped learning is a student centered model. In a traditional classroom, the educator is the active agent in the process – the teacher lectures and provides information to the class. Students largely play a passive role, listening, absorbing information, and taking notes. Students become active in the traditional learning process by asking questions or participating in discussions, but by and large they are sponges soaking up information.

Outside of class, students complete readings and homework assignments, away from their teacher. In the traditional classroom method, the onus for the transmission of information is from the active educator to the relatively passive student.

Under the flipped classroom method, the onus for active learning is placed on the student. Students use class time to practice lessons they have learned outside of class, applying lessons gained through assigned readings and video lectures. In class, students solve problems, analyze cases, and work on projects.

In the flipped classroom, the role of the educator is not passive, but it is transformed into one of learning management. In class, the teacher becomes a coach or facilitator of learning, guiding the students through the solution of problems and the preparation of analyses. The teacher is freed up from conveying information through lectures and can employ different learning modes, depending on the students' needs for that day. Teachers can provide one-on-one instruction to individual or small groups of students and give real-time feedback, assessment, and support. They can tailor instruction to the particular student's level of mastery of the material, or to the specific aspects of the problem causing students the most trouble.

Six Lessons Learned by Doing

My experience with flipped learning has not been as neat and clean as the previous paragraphs might suggest. There was very little guidance available, either at my institution (Cal Poly) or from online sources. I was familiar with the concept and found it appealing, but the practice proved difficult to implement. Our University President calls Learn by Doing "the cornerstone of the educational approach" at Cal Poly[3]. True to our motto, that is how I developed my own approach to flipped learning. From my perspective, each educator needs to create his or her own version of flipped learning, choosing from the many best practices now available those which are most appropriate to each educator's situation and goals.

To be sure, there are common elements that characterize all flipped learning approaches. The FLN proposes The Four Pillars of F-L-I-P as a starting point[4]:

F – Flexible Environment
L – Learning Culture
I – Intentional Content
P – Professional Educator

Unfortunately, my experience began with a different set of (crumbling) pillars, from which lessons can be drawn. I learned that an "all or nothing approach" was not a good starting point

because its underlying assumption of "What can possibly go wrong?" was invalid. I failed to communicate the concept well to students. I did not properly organize in-class projects and activities and failed to realize my role as facilitator and coach. I mistakenly assumed students would do the necessary readings and video assignments in preparation for class without incentivizing them to do so. I also failed to anticipate and prepare for significant student pushback.

In the three years I have been working with these tools, I have been able to expand their use from one course to three. Another professor in my department has also adopted the flipped method and uses the materials I developed. I use the inverted classroom to teach college juniors and seniors material in finance and strategy, but the methods were developed by Professor Eric Mazur at Harvard to teach science courses. The approach is broad enough to adapt to any curriculum without much trouble, but it is well-suited for the sciences.

Here are some of my early lessons learned.

1. Communicate the Concept

Student acceptance of your efforts to transform the classroom environment is central to your ability to succeed. Keeping students informed of what is happening and how it benefits them is essential to helping them become comfortable with the changes you are bringing to their education. Without sufficient communication between you and your students, resistance to your efforts will develop. It can become quite strong. Clear communication is more preferable than managing student pushback.

Your syllabus is the first place to share information with students. This assumes students read the syllabus in the first place, but it puts the educator on record about his or her intentions from the very beginning. At the first class meeting, the educator needs to emphasize the changed structure of the class and explain the direction he or she will be taking. Having a good description in the syllabus will help the teacher establish the rules and expectations for the new classroom format, and will aid in managing student expectations later in the term.

Here is how I introduce the idea in the syllabus:

> *A Comment on Learning:* Learning any subject matter is not simply the acquisition and accumulation of facts, or the regurgitation by the student of correct information. Learning involves the assimilation of facts into new information and integrating new information with your own knowledge and experiences. The student is learning when he or she can take something from one context and apply it in a different, unfamiliar context. The delivery or transfer of information by the instructor to the student is not sufficient to help the student learn or understand the material. Students must take an active role in the learning process.
>
> In this course, active learning opportunities will be provided, requiring the student to engage directly in learning. The lessons for each class meeting are designed by the instructor on the assumption that the assigned readings from the textbook, video lectures,

and lecture notes will be completed by the student before class. If students prepare for class by reading the assigned texts and course notes, and letting the instructor know what parts they find most difficult, then we can use class time to work together to develop a deeper understanding of the material.

We cannot discuss all materials in class; still, students are responsible for mastering the necessary materials in order to reach the learning outcomes stated in the syllabus. This requires the student to engage an active learning approach in this class.

Who knows? Discussing your expectations and their responsibilities might even entice students to read the syllabus through.

In laying out your new approach, it is very important not to characterize your effort as "flipping" or "student centered learning." If students have heard about flipped learning, it has most likely been through the student grapevine and campus rumor mill. They will not have an accurate understanding of the pedagogy behind your approach and they are likely to take a closed-minded attitude from the start. If so, you will have an uphill battle from the first day.

Some students will be curious and willing to work with you, but the majority will be very skeptical. They will not want the onus of their learning to be placed on their shoulders. It sounds like too much work and they will respond as though you are lightening your teaching load by burdening them with more to do. So avoid referring to the new system as a "flipped classroom."

A better approach is to emphasize the important benefit students will derive from this new method. Very few of them will grasp the benefits at the beginning, and many will not see it that way at all. So the teacher must spell out the advantages students are going to experience. It doesn't hurt to continue showing students the benefits during each class period. Sometimes it needs to be done with each lesson.

It is also helpful to emphasize to students the importance of preparing for each day's activities before they come to class. They will not do well with the in class work if they have not done the advance reading and watched the video lectures before stepping foot in class. Do not emphasize the changed format. Instead, let the students know you expect them to prepare themselves to get the most value from the in-class activities.

You want to develop a routine for the students. If you repeatedly inform them they could feel lost or fall behind if they are not prepared they will eventually get the message. It is also helpful to give students plenty of lead time on what to expect in the next class, and lay out what work they need to accomplish to be ready for the activities you have planned for them. If they can see what is coming down the road and what they have to prepare for ahead of time, you will have less difficulty establishing a routine for them to follow. A routine helps you achieve student buy-in.

The ASCD (formerly the Association for Supervision and Curriculum Development) laid out five benefits in 2013.[5] My experience in the last three years is consistent with the ASCD position:

1) Improved Student-Teacher Interaction
2) Real-Time Feedback
3) Student Engagement
4) Self-Paced Learning
5) More Meaningful Homework

In communicating the concept, you will find yourself teaching students how to take advantage of the new materials you have prepared and how to better manage their time. From my perspective, the benefits most appealing to students are self-paced learning, real-time feedback, and the ability to work on real-life problems and projects during class time under supervision of the teacher. If the instructor places emphasis on these valuable features, students are likely to respond with some interest and measured enthusiasm.

2. Think Through Classroom Projects and Activities

A major mistake I made during early efforts to invert the learning experience was not preparing enough for in-class activities and projects. I didn't have sufficient numbers of activities available when I started, and I didn't think through how to use them to manage class time and the learning experience. As a result, students thought my approach the first time was ad hoc and improvised, which generated resistance.

The active learning approach is likely quite different from what most students experienced in high school and in previous college classes. It is important for the students and their teacher to realize that active learning begins for both before class meets. The educator must make an effort to get feedback from students before each class session so the educator can begin to tailor the day's lesson to the specific needs of the class. It is difficult to prepare appropriate in-class problems or assignments without understanding how far student mastery of the material has developed.

Before each class, you need to require students demonstrate they have done the readings, watched the video lectures, and are in general prepared for the problems they will work that day. I did not understand well at the beginning that I needed to help students prepare for each class by making sure they knew what subjects and materials they would cover in the next class, by letting them know how they needed to prepare, and by giving them some idea what they are expected to accomplish. I found if I asked them to prepare but did not let them know what they were preparing for, they were less likely to apply themselves beforehand.

One solution for this problem is Just-in-Time Teaching (JiTT).

Basically, the idea behind JiTT is to require students to communicate to the teacher before class their level of preparation for the day's lesson. The George Washington University says that "pre-planning is the key to JiTT success."[6]

There are various ways to do this, but I chose to ask them questions about the reading and video lectures in an online forum. Students are required to respond by a deadline before class so I can read and grade their comments. Using this information, I can craft the day's lesson to fit the dominant themes in their comments – their questions, topics that are unclear, difficulties they encounter, and so on. I design a short, to-the-point lecture to address their concerns and then assign work that will help them overcome their difficulties. This class work is also graded.

Student feedback is useful to the teacher, who can use the information to shape the day's lesson plan to suit the specific needs of the students at that time. In a way, the lesson plan is prepared by the students themselves. Armed with this information, I have never been at a loss regarding what needs to be done during the next class session. So the day's work begins with the students' brief pre-class comments and ends with an extended application of the lesson. Both activities are graded to motivate students to get the work done.

3. Give Students More Information Than They Can Handle

It took me a couple months to appreciate what an information hog the flipped learning format can be. Students provide more information in their regular feedback than a teacher can process. Fortunately, the educator can select the most useful feedback for lesson planning purposes. Information that isn't used to design the day's lesson plan can be addressed by other methods – posting articles on class blogs, answering questions in e-mail blasts to the class, asking students to drop by during office hours to discuss their thoughts, filing away for later reference, or ignoring it.

Realize that the information flow is two-way; it is important for the educator to provide students more information than they can process. This is not difficult to do given the numerous sources of quality information technology available for classroom use these days – drop boxes, blogs, Blackboard, Moodle, Twitter, eTexts, online learning systems (such as those available from Aplia and Pearson MyLabs), YouTube, Tumblr, RSS feeds, and the list goes on.

Flooding students with information might sound counterproductive, but in fact the educator can use the flood to better prepare the class. At first, I was a bit reluctant to expose students to more information than I thought they could handle, but what I found out was marvelous – students began to engage with me to discuss what information was useful and how they were to incorporate it into their learning methods. They began asking for help in organizing and structuring their knowledge, in other words. And what is a teacher for?

When faced with the prospect of drowning in information, rational students decide they need to find a way to sort through it, figure out what is useful and what is not, and begin putting it to good use. They actively manipulate the information and extract meaning from it. At the same time, and I did not at first anticipate this, they realize they were not prepared for this task by their previous education experiences in high school and college, so they seek out assistance from first their peers, and then from their instructor.

At this point, I realized the students needed me to facilitate and supervise this process for them. They want to get it right and their teacher becomes the best resource available. The teacher is now in the position of providing real-time feedback to the students' efforts and assessing on the spot the level of student understanding.

Recall that the role of the educator in the inverted classroom system transforms into that of a facilitator or coach. This method of information overload turns out to be a useful agent for this transformation, in my experience.

I found the university library a great place to start. At Cal Poly, librarians will set up a research portal for individual classes[7] and include on the site every conceivable online resource for students to access. A JiTT assignment asking students to visit a library research guide, select two or three online sources, and catalog what can be found there serves as an introduction to the depth of information available to students and gets them started on the task of structuring and organizing their knowledge.

4. Get Students Prepared

Two pedagogical methods boost the effectiveness of the flipped learning method: Just-in-Time Teaching and Peer Instruction. These methods excel in preparing students for in class learning.

The George Washington University describes JiTT as:

> promot(ing) active student engagement and increased learning by intentionally linking out-of-class and in-class activities. Before each class meeting, students answer a small set of web-based questions on upcoming course material outside of class and submit their responses online a few hours before class begins. Once submitted, the instructor reviews the students' JiTT responses and develops in-class active-learning exercises targeting students working learning gaps identified in the JiTT responses – 'just in time' for class.[8]

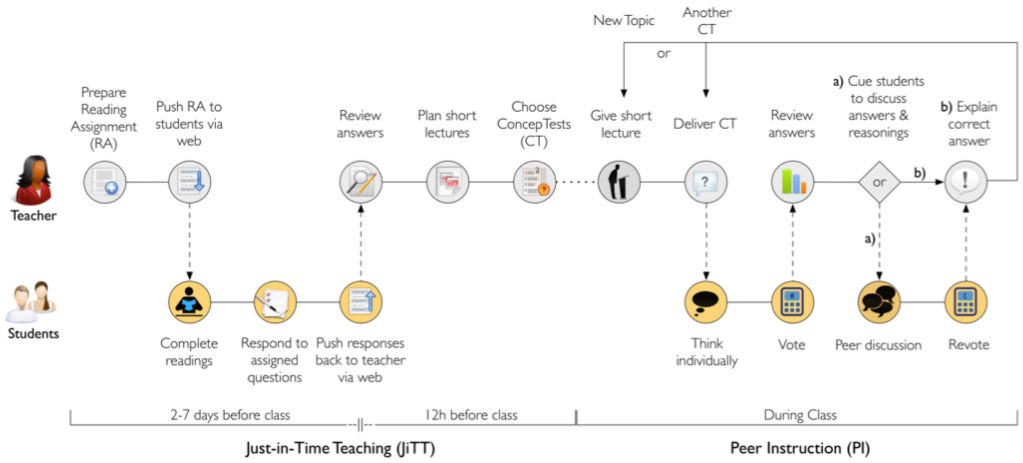
A leading proponent of Peer Instruction is Eric Mazur, a professor of Physics at Harvard University. In a 2001 study he co-authored, the Peer Instruction method is described as "engag(ing) students during class through activities that require each student to apply the core concepts being presented, and then to explain those concepts to their fellow students." The study credited Peer Instruction with "increased student mastery of both conceptual reasoning and quantitative problem solving."[9]

Separately, JiTT and PI are effective methods for improving student performance and learning. In combination, they can be powerful, especially in the hands of an experienced instructor practicing within the context of the flipped learning format.

Before I began working with the inverted classroom approach, a major concern was how to motivate students to do the assigned readings and spend time viewing lectures on YouTube before coming to class. The student preparation problem seemed particularly vexing and no easy solution suggested itself. It was obvious that without adequate preparation before class time,

students would not be positioned to take advantage of in-class work built upon the lessons from the readings and lectures. Motivating students in this area is critical.

One way to implement JiTT and PI in combination, used by Ives Araujo, a professor at the Federal University of Rio Grande do Sul in Brazil, is illustrated below.[10] JiTT is use to prepare students before class and PI is employed in class to build on student preparations.



Professor Araujo's study shows that 80% of his students did each pre-class reading assignment, and that "90% of the students' submitted answers demonstrated engagement, for example through a justification for a submitted answer, discussion of the content they found difficult, or discussion of the content they found motivating."[11]

As with much of flipped learning, there are many different, but equally effective, ways to implement JiTT and PI. It is important that educators determine what works best for them in their particular circumstances and in the context of their particular courses. In general, it is important to give considerable thought to the where, when, how, and why of JiTT and PI.

In terms of JiTT, it is necessary to develop a good set of questions to ask students before class, in order to elicit from them valuable and revealing feedback the instructor can use to design the lesson for the day. The questions need not be sophisticated. Professor Araujo asks his students, "Did you find anything difficult or confusing in the reading? Which parts? If you didn't find anything difficult or confusing, describe what did you find most interesting in the reading. Do you have any questions?"[12]

I ask similar questions to get broad and general answers one day, then follow up the next day with very specific questions to which students must give a precise numerical answer or indicate the correct answer for a multiple choice question. I also ask students to choose an incorrect answer and explain to me why they think it is wrong. The point is to link the pre-class questions and responses with the in-class projects in such a way the students see the connection and come to expect it routinely.

When students realize they are graded for the quality of their answers, and make the connection between the JiTT reading before class and the in-class graded PI activity, their motivation to prepare becomes more apparent.

The JiTT pre-class responses can also be used by the instructor to shape the PI exercise in class. The teacher will know from the responses which students understand the material better than others, and can use this information to form student groups in which knowledgeable students are placed among their less advanced peers. These groups can then begin to discuss and solve problems in class, during which discussions the more knowledgeable students will share what they know with their peers.

Soon, the students themselves understand who knows what; they begin to form groups around those students the others consider well-informed. These knowledge leaders share what they know with the others, and students start learning from each other. Peer Instruction sometimes appears almost a spontaneous event, one that is very rewarding for the educator to watch blossom in the classroom.

5. Manage Student Expectations

Regardless of how well you have laid out the transition to the flipped learning format, or how thoroughly you might integrate JiTT and PI activities, managing your students' expectations is key to the success of your efforts. Under the best of circumstances, student pushback can be significant. Educators cannot allow student resistance to undermine progress or sap confidence. If students know what to expect, the transition will go as smoothly as possible. Students don't like surprises.

Catherine H. Crouch and Eric Mazur wrote in 2001, "It has been established that students often require a period of adjustment to new methods of instruction before their learning improves."[13]

Some degree of student pushback is inevitable so it is best to prepare for it. A proactive approach will serve you better than a reactive position. Otherwise, when resistance arises you risk becoming distracted.

It is natural for students to be confused and uncomfortable as their classroom environment transitions away from the methods they are used to towards something that requires them to become more accountable for their own education. This concerned me when I first encountered it, but I quickly realized the root cause of their discomfort was the fact that they were actively learning.

I tell each class now that the queasy feeling they have in their stomachs is what learning is all about. It is a manifestation of the "Learn by Doing" method, which to my way of thinking is indistinguishable from trial and error. Trial and error in the classroom necessarily involves unfamiliar forms of teacher-student interaction and requires students to make mistakes and learn from them. They must become comfortable with the feeling that failure on an assignment does not mean disaster for them. Instead, students must become comfortable with controlled failure and see it as the gateway to successful learning.

It is essential that the instructor do two things to ride out any early doubts or misgivings that may arise about the efficacy of what he or she is trying to do. First, keep the focus of active learning on the students and don't let them push accountability for their education back on you, their teacher. Second, stay the course and let the "Aha!" moments happen on their own schedule.

Not every student will have an "Aha!" moment, the point at which they realize the satisfaction of understanding what they are doing. But it's not necessary that each student experience a small epiphany for learning to happen. As the instructor keeps pushing forward with the transition to flipped learning, the "Aha!" moments start to occur. When they do, the instructor has to be sure to point those moments out to the class as a whole. Take some time to let students know that learning is going on. Celebrate student progress as they make it and link their growing mastery of the subject to their pre-class preparation and the in-class work they are doing. This is how student buy-in begins.

Students should sense their instructor is leading them through the changes and will be there to provide needed guidance and support when they stumble and get things wrong. The Center for Teaching and Learning at the University of Texas cites many good ideas for "creat(ing) a positive climate/community for learning where students feel supported."[14] This sense decreases the anxiety that drives student resistance and pushback, and helps students accept the flipped learning method. It helps accelerate the arrival of the inevitable "Aha!" moments, in my experience.

Until then, prepare to manage any pushback intelligently and without taking student criticisms personally.

This can sometimes be hard to do. My first attempt at flipped learning led some students to comment negatively on the approach. One student expressed the opinion on a course review form that "a monkey" could do my job. Another stated that students "pay too much" tuition to be expected to "teach themselves." Yet another expressed a desire "to flip the bird" at the professor's class flipping ambitions.

It helps to remember that, in the learning process, the "Aha!" moment is preceded by resistance and pushback. If the instructor provides support and guidance for students as they acclimate to the active learning process, resistance can be managed or even minimized and the inevitable arrival of the "Aha!" moment is hastened along. Support and guidance takes the form of communicating the concept, thinking the process through (especially the in-class assignments), providing lots of information for students to process, and getting students prepared through the implementation of JiTT and PI.

Above all, resist the temptation to negotiate with students over your teaching methods. Listen politely as they criticize your methods and complain how they "learn better" under the "talk and chalk" method. Answer their questions in a straightforward manner without any prevarication.

Let them gripe to their friends, let them pan you in their teacher evaluation forms and on teacher ratings blogs, but make them sweat the trial and error in class. Do not enter into negotiations

with students about how you should be implementing the flipped learning process or debate with them whether it is a good idea at all.

Hold them accountable for their new role and let students know you are looking forward to their meeting your expectations. You cannot win a negotiation with them so it is best not to give any indication you are willing to sit down and talk it out. Hold your ground and you will eventually see students warming up to the new approach just as you have.

It is important to remember you are probably not the only instructor on campus working in the new format. It is likely one or more students in your class already have experience with active learning methods. During the worst of the pushback I encountered at the beginning, one or two students let me know privately that they had already been through a flipped class under other instructors and that they were familiar with what I was trying to do. This was a relief to learn and helped me hold out against the tide of criticism. And this, like all tides, will flow before it ebbs.

6. Peer Instruction is Your Friend

Peer instruction is an effective pedagogical method. As Cassandre Alvarado, Assistant Dean for Undergraduate Studies at the University of Texas stated, "PI helps students engage in the higher order thinking skills of metacognition and related activities, such as self-monitoring and self-regulation that are essential to succeed at the college-level and beyond."[15]

But PI is also a key to getting student buy-in to your active learning approach. Students learning from other students accelerates the buy-in process. Students who understand the material well enough to lead other students in Peer Instruction demonstrate to the most reluctant among them how to make the inverted classroom work. This is a powerful example for students to witness.

Subtle peer pressure combines with the self-monitoring and self-regulation and learning begins to spread among the class peer group. It is one thing for the teacher to demonstrate a method to a class but quite another for one student to work it out then lead others in the lesson. Students see their peers' growing mastery of the subject matter and develop a keen interest in not being left behind. It is peer pressure at its best.

To borrow a phrase, "Students learn best by teaching others."

Conclusion

In my experience, the flipped classroom method combines lecture videos which students view before coming to class with class time reserved for problem-solving exercises, Just-in-Time Teaching utilizing reading forums and customized teacher feedback, Peer Instruction, case work and discussions, writing exercises, and performing online exercises and research.

As a result, class time is better structured, and the teacher can address special concerns and weaknesses expressed by individual students about the material. The teacher has more interaction with individual students during class and can provide one-on-one instruction in short

bursts to students hung up on a particular problem or application. Interaction with students provides feedback, so the teacher can perform real-time assessments of student skill levels and mastery of the material and can adjust the curriculum and the pace of the class accordingly. Students also benefit from the ability to watch video lectures on their own time, pausing the recording to work on lecture problems, and repeat difficult sections for better understanding.

The major disadvantages of the flipped classroom format are student pushback and resistance to active learning methods, the amount of prep work that must be done to produce video lectures and to prepare assignments for each class session, the need for quick turnaround of in-class assignments for student assessment purposes, and the lack of quality support available to educators who wish to employ the approach.

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