Preliminary Report on Flipping the Classroom: Abstract Algebra

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I've been interesting in flipping the classroom for quite some time now, but never knew exactly the perfect time to try nor best method of delivery to use. In fact, when on the planning committee for CCD (Community and Collaboration Day, our professional day each semester) at NSU in fall 2013, I found it the perfect opportunity to propose a session on "flipping the classroom" so that we might hear from some of the most experienced faculty on campus that have tried this technique.

For those of you who do not know what "flipping the classroom" is, I will try to explain the basic concept. Instead of the traditional class delivery (which in most cases consists of in-class lectures, followed by take home assignments that are then turned in/graded/returned followed by periodic exams over the covered material and then repeated throughout the semester until the final exam), content is delivered primarily outside of class and the in-class times are used for group work or presentations of problems that directly relate to the outside materials. Now, exactly how the material for self-study outside of class is delivered and how the work is done/assessed while in class sessions is the hot topic for debate and how systems of "flipping the classroom" could differ greatly from one implementation to the next. What this paper will do is provide the background of what course this was implemented in, what text and topics are usually covered, my individualized method of "flipping the classroom" that was utilized as well as some pros/cons and a little bit of feedback that was received.

First of all, this was done in a section of Abstract Algebra taught at our Broken Arrow campus during the Spring 2014 semester. The course was offered at night and met only twice a week for 1hr and 15min each session. Contact time with the instructor was limited since it was at our branch campus, I'm primarily based in our Tahlequah location which is a 1hr commute one each way, so they had the following contact availabilities through the semester: office hour times before/after each class, in class group work time, and considerable access via email/texting throughout the week. Historically, this course had been offered in a very traditional format consisting of lectures/HW assigned over lecture/exams and then repeated. The traditional content that would be covered was: Fundamentals (sets/mappings/binary operations/relations), The Integers (Mathematical Induction/Divisibility/Congruence Classes), Groups (Definition/Properties of Group Elements/Subgroups/Cyclic Groups/Isomorphisms and Homomorphisms) and time permitting (Finite p-groups/Cayley's Theorem/Cosets/Normal Subgroups/Quotient Groups/Direct Sums). If I was to utilize "flipping" in this situation, I'd want to get the maximum benefit of the direct contact with students during class times but also cover as

much of the normal content they might have traditionally seen in the class. I think this is probably the primary reason that I (and perhaps, most others) really question whether they will even attempt to "flip" one of their classes.

As I said earlier, I've been interested in this method for quite some time but I really wondered not just if I could cover basically what they'd see in a typical setting but also whether this was the right time to "experiment"? I was teaching this class at our branch campus and only two nights a week, so there was going to be very minimal contact with the students outside of class and they couldn't just "stop by my office" on an off day since most of these students don't take classes at both campuses. Another strike going against "flipping" at this time was I had been assigned Abstract Algebra, a course that I'd never taught in my entire teaching career to this point! So, I struggled with having enough "intuition" with the subject in order to carry this out successfully. But the more I thought about it, perhaps this "con" was really a "pro"? Since I had never taught this subject in any prior setting, I'd have no preconceived notions or expectations and perhaps this was the best possible setting in which to try something completely new; so I decided to "go for it"!

The positive aspects I saw in this "experiment" was my intense interest in the method (to see if it was viable, and if I could make it work), students typically struggle with any proof-intense course no matter what the instructor might try and it would give me a chance after many years of teaching to try something new/fresh. Some of the negative aspects that I knew ahead of time included: planned missed classes for major spring conferences (JMM, ICTCM and OK-AR MAA Section Meeting), this would be taught at our branch campus only twice a week and during evening hours, as well as having never taught the subject before. These would also be accompanied with our very harsh winter experienced in NE Oklahoma (which couldn't have been planned for nor anticipated in any setting).

In a "normal" flipping situation, I have always seen people describe their class as: students are given a strict list of theorems/definitions, assigned a list of specific problems to be covered as completely as possible throughout the entire semester, class time was devoted to student presentation of solutions and exams over this material. I had never attempted "flipping" before this point because I never saw this model working with either my typical student or myself. So, I came up with my own modification of the "flipping" motif that I really thought had the greatest possibility for success. On the first day I split the class into groups of two students each, and I let the students picks their own groups with a word of warning that I could swap or mix groups later as I saw need. Due to a slight disciplinary issue that arose in the semester, I did have to split one group and use those two in combination with two from another group and the result turned out very beneficial for all parties. On each Monday I would "reveal" the list of problems that they'd be held responsible for and have them work within their groups (but independent of the other groups) and I would pass between the groups asking questions and making sure they were progressing/staying on topic. On each Wednesday, I would randomly select problems (and presenters!) until we'd either exhausted the problem list or run out of class time. If a student was unable to come up with an attempt at a solution, then I'd

randomly select another student to try but then come back to the student for another problem to present. I would then give an exam over each unit and repeat this process on a new unit. Some additional "tweaks" that I came up with to help the process along were: I'd assign a class reading from the text over the weekend before presentation day (with the promise that they could request help, further examples or even a YouTube video for further explanation!), and I only allowed them consultation within their own group/myself during group time or consultation outside of class in my office hours, by email or text.

Some of the outcomes I saw were a very pleasant reward for the stress and strain this format placed upon me: I repeatedly heard from students that they "understood the idea of proof" more and more as the semester progressed, I was there while they were working on problems to see the "issues" as soon as they arose, and I saw student growth not only in their confidence to present but also in their mathematical ability to prove results. There were issues that came up which I could have neither foreseen nor planned for, which included: an occasional student would miss either group day or presentation day (but on the whole, attendance and effort were very good throughout the semester), less than optimal contact opportunities outside of class (which might have been helped if the courses were offered on a MWF format, or not during evening hours at our branch campus) and we had a few days missed during the harsh winter we experienced in the area.

So, what sorts of methods of "flipping the classroom" are you trying with your classes…? What is working…and what's not?