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A How-To Workshop to Effectively Flip a Class

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Abstract

This paper will provide effective strategies for the design and implementation of a flipped, hybrid class. When presented with a unique opportunity for accelerated course offerings for Math 21: College Algebra I at the Pennsylvania State University, The Behrend College, we developed a flipped, hybrid course for nursing students. Lessons learned from this process, best practices derived from the experience, and course demonstrations are shared. This workshop was presented at The Teacher Professor Conference, June 2-4, 2017 in St. Louis, MO.

Math 21: Hybrid College Algebra I for Nursing Students

In the fall 2014, I was approached by the School of Science Director asking if I would be interested in teaching a hybrid College Algebra course, which I gladly accepted. The course is part of the accelerated bachelor of nursing program at Penn State Behrend and I had to create a course with specific applications for nursing students. When first faced with this new endeavor, I knew I needed help from others. Reaching out to the various nursing instructors at Penn State Behrend, I gained a wealth of information on how to incorporate nursing applications into the class. When it came down to building the course online, I had help from my colleague, Jessica Resig, Director of World Campus Learning Design and Behrend Center for eLearning Initiatives. Through our collaborative efforts, the 7-week course was online and ready to go within a period of two months.

Pre-Reading to Understand the Nursing Profession

When I found out this would be a class for nursing students, I wanted to find, specifically, how mathematics are used in the medical profession. In the medical field, the administration of medicines is a large part of a nurse's job. With the 21st century, the times nurses are preforming medical calculations have decreased, Hoiston (1996) estimated that at least one person dies each day in the United States due to medication errors. When first reading this, I strived to give my students all the mathematics they would need to be confident in their careers. In the nursing textbooks I have looked at, most of them present problems with formulas and having students substitute numbers without giving much thought about why they are calculating medical dosages. There are two large problems with this procedure. First, in a study done by Hoyles, Noss, and Pozzi (2001) where twelve nurses were observed found the nurses mostly relay on proportional reasoning strategies. Although the nurses can remember formulas taught in their schooling years, they always returned to the methods of proportional reasoning to avoid any complex division and multiplication. The second problem with using the substitution method and formulas are outlined in the study by Blais and Bath (1992). Here, the conceptual errors in medication administration were more frequent than mathematical errors and measurement errors. The set-up of dosage calculations was of the more common type of error. Mistakes are made at any profession and are not unique to nurses. According to sociologist E. C. Hughes (1951), people working in all occupations make these errors and suffer a great deal of anxiety as a result. Wolf (1994) recalls how terrible she had felt when, "Oh, my God! I pulled out the wrong one!"

The initial thought was to not tell anyone what happened, however, mistakes such as these in the nursing field must be reported. It is a matter of life and death.

Outline of Math 21

As the course was part of the accelerated bachelor program for nurses, the nursing department wanted the course to be 7 weeks long. Typically, Math 21 is a traditional 15-week course that meets for 50 minutes on Monday, Wednesday, and Fridays or Tuesday and Thursdays for 75 minutes. Teaching this course in a regular fall and spring semesters is hard enough to get through material in a 15-week semester, let alone, a 7-week semester. I needed to think about how to best split up the class to make sure all bluebook concepts were covered along with the nursing applications. In terms of the required concepts, the course needs to cover concepts of quadratic equations, equations in quadratic form, word problems, graphing, algebraic fractions, negative and rational exponents, and radicals. The class would meet every Thursday for 2.5 hours, so time was critical to say the least. With the nursing applications I received from the nursing department, I wanted to include topics on unit conversions, Bishop's Score, Radon Gas Risks, Growth Charts for Boys aged 2 – 20 years, Girls Growth Charts from birth to 36 months old, Fahrenheit vs. Celsius, Incidence of Diabetes in Adults ages 45 – 64, Life Expectancy, Training Heart Rate Zones, BMI, Calculating pH, Spread of Viruses, Cancer Cell Simulation, and Eliminating Medicine from the Bloodstream. As we can see, I had a lot of good topics to work with. The way I structured my weekly classes was the following:

Week	**Topics**	**Group Application**
Thursday, January 15, 2015 Week I	1. Set-up MML accounts. 2. Scientific Notation. 3. Linear Inequalities. 4. Compound Inequalities. 5. Absolute Value Equations. 6. Absolute Value Inequalities.	1. Unit Conversion Lab. 2. Bishop's Score. 3. Radon Gas Risks. 4. Growth Charts, Boys 2 - 20 years & Girls birth – 36 months. 5. Metric Mania. 6. Dosage Calculation
Thursday, January 22, 2015 Week II	1. *MML Homework, § 2.4 – 2.7 Due.* 2. *Post-Test on Chapter 2 Due.* 3. Graphing Equations. 4. Introduction to Functions. 5. Graphing Linear Functions. 6. The Slope of a Line. 7. Equations of Lines. 8. Graphing Piece-wise-Defined Functions, Shifting, & Reflecting Graphs of Functions. 9. Graphing Linear Inequalities.	1. Fahrenheit vs. Celsius. 2. Incidence of Diabetes in Adults Ages 45 – 64. 3. Life Expectancy parts III. 4. Protein Intake. 5. Training Heart Rate Zones. 6. Graph of Heart Rate over Time.
Thursday, January 29, 2015 Week III	1. *MML Homework, § 3.1 – 3.7 Due.* 2. *Post-Test on Chapter 3 Due.* 3. Exponents & more on Scientific Notation. 4. Polynomials and Polynomial Functions. 5. Multiplying Polynomials. 6. The Greatest Common Factor and Factoring by Grouping. 7. Factoring Trinomials. 8. Factoring by Special Products. 9. Solving Equations by Factoring and Problem Solving.	Class will be working on MML homework, applications within MML.
Thursday, February 5, 2015 Week IV	1. *MML Homework, § 5.1 – 5.8 Due.* 2. *Post-Test on Chapter 5 Due.* 3. Rational Functions, Multiplying, & Dividing Rational Expressions. 4. Adding & Subtracting Rational Expressions. 5. Simplifying Complex Fractions. 6. Solving Equations Containing Rational Expressions. 7. Rational Equations & Problem Solving. 8. Variation & Problem Solving.	1. Textbook applications. 2. Variation applications (non-nursing examples).

	9. Radicals and Radical Functions. 10. Rational Exponents. 11. Simplifying Radical Expressions. 12. Adding, Subtracting, & Multiplying Radical Expressions. 13. Rationalizing Denominators & Numerators of Radical Expressions. 14. Radical Equations & Problem Solving.	
Thursday, February 12, 2015 Week V	1. *MML Homework, § 6.1 – 6.3, 6.5 – 6.7, & 7.1 – 7.6 Due.* 2. *Post-Test on Chapters 6 & 7 Due.* 3. Solving Quadratic Equations by Completing the Square. 4. Solving Quadratic Equations by the Quadratic Formula. 5. Solving Equations by Using Quadratic Methods. 6. Quadratic Functions & Their Graphs. 7. Further Graphing of Quadratic Functions.	1. Additional Life Expectancy. 2. Heart Rate Data. 3. More on Heart Rate. 4. More on BMI. 5. Applications to Quadratics (non-Nursing examples).
Thursday, February 19, 2015 Week VI	1. *MML Homework, § 8.1 – 8.3 & 8.5 – 8.6 Due.* 2. *Post-Test on Chapter 8 Due.* 3. Exponential Functions. 4. Exponential Growth & Decay. 5. Logarithmic Functions. 6. Properties of Logarithms. 7. Common Logarithms, Natural Logarithms, & Change of Base Formula. 8. Exponential & Logarithmic Equations & Problem Solving.	1. Calculating pH. 2. Spread of a Virus. 3. Compound Interest applications (non-nursing examples). 4. Scientific Applications with continuous compound formula. 5. Cancer Cell Simulation.
Thursday, February 26, 2015 Week VII	1. MML Homework, § 9.3 – 9.8 Due. 2. Post-Test on Chapter 9 Due. 3. Sequences. 4. Series. 5. The Binomial Theorem. 6. Review for Final Exam. 7. Post-Test on Chapter 11 Due on 3/1 at 11:59 pm.	1. Eliminating Medicine from the Bloodstream.

During Week I, I showed students a PowerPoint on Scientific Notation, Linear Inequalities, Compound Inequalities, Absolute Value Equations, and Absolute Value Inequalities. However, for all other weeks, students were required to view video lectures I had created under the guidance of my colleague Dr. Resig.

The Science to Flipping a Class

When first asked to teach a hybrid class, I needed to learn what makes a hybrid class a hybrid class.

> According to Lorenzetti (2013), Instead of using class time to convey the basic information you want your students to remember and asking them to work on more difficult learning tasks alone, a flipped class asks students to come to class prepared with the foundational information and then to work on the challenging tasks of analysis, evaluation, and creation with others.

When first starting to think about how to flip a class, which I had never previously done in my career, I had to think back to how college works. While going through my college career, I had to take my own initiative and learn things on my own. After a 50 minute class, I would spend 3-4 hours working out problems, re-working my notes, finding additional resources to make them work to aid my learning. Then, in class, I would ask follow-up questions to further engage myself to get the most out of my learning. What I have outlined above was my starting point to creating my hybrid class. The learning was placed on the students so that when they came into class, they were ready for the checkups and to apply their knowledge to nursing applications. If we think about it, we as faculty spend many hours helping our students in office hours and answering emails. With a flipped class, the instructor can work with students directly as if they are in a big office hour. This, of course, will vary on class size. As Hill (2013) points out,

> Faculty can then devote time to helping students develop synthesis and explore application during class time through: experiential exercises, team projects, problem sets, and activities that previously have been assigned as independent homework. In particular, students can receive direct faculty input on those segments of the material that have historically been the most [difficult] or ambiguous.

When teaching my flipped class, I found that topics such as factoring trinomials were easier for students to understand, especially when factoring trinomials where the leading coefficient was not one. With using colors on the video and having the check-up for this concept alone, I saw a great improvement in students being able to know what do to and to solve the problem faster than in a face-to-face class. However, as with teaching any class, the students must be driven to work. As Ullman (2013) points out,

> It requires students to be independent. It's an excellent growth opportunity, but the student has to be willing to put in the time and be an active participant in the learning. Some [students] listen, do a little homework, and get by. That won't cut it in the flipped classroom.

In a flipped classroom, it is imperative to convey to your students that the course is *NOT* a traditional face-to-face class. Caldarera (2013) writes, "The flipped classroom format, [students] will be expected to complete the lesson as homework. All instructions are to be followed so as to allow more time for engaging enrichment activities in class. One important piece of advice I would like to share is to send out a welcoming email to the students before class begins.

In teaching this course, I have found that having this email and talking to students on day one about the course proved to be very helpful. Of course, the students I had for this course had taken other hybrid classes in the past and knew they needed to work hard. If you have a class of students who have never had a hybrid class they may be overwhelmed and even walkout on the first day. I have found that the student, who is driven to learn on their own, is willing to discover, and wants to be the best they can be, will thrive in a hybrid class.

With my experience, I offer the following best practices to flipping your own class with the emphasis not all these ideas may work for every class and instructor:

1. **Make the class personal.** Often times, the only time your students will see you lecturing is through video lecturers. Try to make the videos, as you would want to be seen if you were being recorded for a giving a talk at a conference. Keep it professional but fun.

2. **Make it engaging.** When students are looking at your videos, if they find them boring, they will be more likely to resort to other videos to obtain information.

3. **Make it short and segmented.** As stated earlier, videos should not be long, as students will become disengaged after 10 minutes. This is true of video lecturers and face-to-face lecturers.

4. **Make it relevant.** As in a face-to-face class, the key to a successful flipped classroom is to relate problems to real-life applications. In Math 21, I had no problem creating applications for nursing students.

5. **Make it a two-way street.** Although I didn't try this, what I'm thinking about for the next time I teach the class is to have students make their own videos or to come up with exam problems or critique other students' work. This way, students have more control over their own learning.

6. **Have an introductory video about a flipped classroom.** I also didn't try this but to create a video where a flipped class is explained may help students understand how the class will run before the first day of the semester.

7. **Take attendance.** I didn't have a problem with attendance in my class but I can see it being a big problem for other classes. With a flipped class, the student must be present. I see a student missing a flipped class as being the same as missing a physics lab, which is very hard to make up. Also, give a grade reduction for students who do miss class.

8. **Unprepared students.** Students who don't watch videos or read the text before coming to class can cause a huge disruption. Here, make a seating chart and keep track of the students who are not prepared for the week. Offer one chance to redeem them and ask students questions the next class period instead.

9. **Don't assign too much homework.** Before starting the class, think about which problems test the concepts more than others. Remember, students are doing twice as much work outside of class while in a flipped class. You

want to have clear goal on what you want students to be able to do at the end of the semester. In short, developing learning goals is vital.

10. **Access to materials online.** Although it is 2015, some students still don't have regular access to computers. At the start of the semester, stress to students that they must have access to a computer either through family/friends or at public libraries or at school. Not having computer access is simply a no-go for a flipped class.

11. **Lots of prep work for the instructor.** When first faced with creating a hybrid class, you as the instructor need to devote a lot of time to preparing the class. The ideal time to prepare for a flipped class would be over the summer as the three months or so will give plenty of time to get videos, activities, announcements, syllabus, assessments, and homework ready to go.

12. **Monitor students work online.** With MML, it is very easy to see who is doing the work and who isn't. Stress to students deadlines and have a clear policy in place about late work. Also, talk to your IT specialists to see how you can monitor who watches video lecturers to make sure they are being watched.

13. **Large classes.** Although I have not had a personal experience in teaching a class larger than 50 students, I don't see how a flipped class of say, 300 students, would work. Sometimes, a class shouldn't be flipped.

14. **Allow feedback.** When teaching the course for the first time, I gave three feedback forms to my students to complete on ANGEL. The more feedback I received, the better the class went.

15. **Talk to fellow colleagues about their experiences.** Often times, the person next door to your office can provide you with a great wealth of experience. Don't be afraid to ask for advice.

16. **You are still the professor.** Even though the learning of the concepts happens outside the classroom, you are still the professor guiding students along and offering your wealth of knowledge in the face-to-face time with the students. Don't be discouraged about the new way of running your hybrid class vs. your traditional class, embrace it!

17. **If things go wrong.** Not everything will go right. Learn from your mistakes and try again.

18. **Collaborative learning:** The flipped classroom model promotes active, collaborative learning in the classroom because it affords more time in class for group activities and deeper interactions. In addition, flipping improves affective responses to the instruction.

19. **Self-discipline:** Flipped learning encourages self-discipline and greater autonomy and accountability for learners who must come to class prepared in order to actively engage in the learning environment.

20. **Applications:** Flipping the classroom and integrating hybrid learning improves teaching practices by allowing for application-based and ill-structured problem solving in the classroom environment during class time.

21. **Class size:** Hybrid learning addresses strategic needs regarding class size and space constraints.

22. **Scheduling:** Hybrid classes allow students more flexibility when scheduling, which is critical for adult learners (and traditional learners with increasing demands from work/family/extra-curricular activities, etc.)

Conclusion

While the course content we used related to College Algebra, the broader principles used to design the flipped and hybrid classroom can be applied to any subject matter. The energy and enthusiasm we always have in a face-to-face class needed to be transferred in a new arena where students could think without the professor's physical presence. We would highly encourage anyone who is thinking of trying the flipped classroom approach to not waste time thinking about, but to do it. It will make you stop and think about how to deliver your teaching in a new light.

References

Blais, K., & Bath, J. (1992). Drug calculation errors of baccalaureate nursing students. *Nurse Educator, 17*(1), 12 – 15.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). How people learn: Brain, mind, experience, and school. Washington, DC: National Academy Press.

Caldarera, L. (2013, April 23). *Flipped Classroom – Best Practices.* Retrieved from http://prezi.com/-yrrp4lyodap/flipped-classroom-best-practices/

Garrow, L. A., Hotle, S., & Mumbower, S. (2013). Flipped classroom. *OR-MS Today, 40*(4), 10.

Gilboy, M., Heinerichs, S., & Pazzaglia, G. (2015). Enhancing student engagement using the flipped classroom. *Journal of Nutrition Education and Behavior, 47*(1), 109-114. doi:10.1016/j.jneb.2014.08.008

Hill, C. (2013, August 26). *The benefits of Flipping Your Classroom.* Retrieved from http://www.facultyfocus.com/articles/instructional-design/the-benefits-of-flipping-yourclassroom/

Hoiston, S. S. (1996). FDA focused on drug and device errors. *Journal of the American Medical Association, 276*(16), p. 1287.

Hoyles, C., Noss, R., & Pozzi, S. (2001). Proportional reasoning in nursing practice. *Journal for Research in Mathematics Education, 32*(1), 4 – 27.

Hughes, E. C. (1951). Mistakes at work. *Journal of Economics and Political Science, 17,* 187 – 196.

Lorenzetti, J. (2013, October 4). How to Create Assessments for the Flipped Classroom. Retrieved from http://www.facultyfocus.com/articles/instructional-design/how-to-createassessments-for-the-flipped-classroom/

Schlariret, M. C., Green, R., & Benton, M. J. (2014). The flipped classroom: Strategies for an undergraduate nursing course. *Nurse Educator, 39*(6), 321-325. doi:10/1097/NNE.0000000000000096

Ullman, E. (2013, April 23). Tools and Tips for the Flipped Classroom. Retrieved from http://www.techlearning.com/features/0039/tools-and-tips-for-the-flippedclassroom/53725

Wolf, Z. R. (1994). Medication errors: The nursing experience. *Delmar Publishers, Inc.*