

Teaching Portfolio

Rutgers University

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1 Teaching Philosophy

One of the most important things in education, and particularly in math education, is the idea of self-efficacy—student’s beliefs about their ability to complete a given task. In my opinion, a lot of students struggle with math because they go into classes with the mindset that math is hard or impossible, and if they were able to get past this, they could be more successful. For this reason, I have focused most of my teaching efforts on trying to improve self-efficacy in my classroom, helping students believe that they can succeed in my class, even if it seems challenging.

My commitment to the goal of improving self-efficacy can be seen throughout all of my teaching, but three types of experiences in particular both demonstrate this very well and have significantly impacted the way I think about teaching. These are

- the Summer 2017 Differential Equations class that I ran as a flipped classroom,
- the Summer 2018 Differential Equations class that I ran as a very active classroom with assignments and projects designed to encourage learning and self-efficacy, and
- the varied groups and communities dedicated to teaching that I have become involved with.

While there are many possible ways to attempt to address the problem of self-efficacy in the math classroom, two of the main techniques that I have tried to use to improve self-efficacy have been active learning and peer teaching. The idea of both of these is that getting students more involved in the learning of the material will help them to internalize it better and understand that it really is not that bad. These ideas became the foundation for the classes that I taught near the end of my time as a graduate student, more details of which can be found in the later sections of this document.

All in all, teaching is something that I have enjoyed for most of my life, and Rutgers has been a great experience in developing myself as a teacher. The various classes I have taught and groups I have been involved in have given me a foundation in and a passion for education that I am looking to expand on in the future. It has taught me that when students are confident and believe that they can complete the tasks you set out for them, it is fairly easy for them to succeed, and it is the job of the educator to set up an environment where this can happen. While we are just teaching a math class, the impact we can make on students goes well beyond that; inspiring confidence in a class that they find difficult will push them to tackle challenges that they face later in life. Calculus may be important, but the belief that a student can surpass whatever obstacles stand in their way is the most important thing that we can try to instill in our students.

2 Diversity Statement

Diversity considerations in the math classroom arise in two different contexts: those directly related to the course material, and those that arise from the classroom environment, indirectly related to the content of the course. The content related issues come out of diversity in levels of prior knowledge. This is particularly important when dealing with a class like Calculus 1 or with freshmen students, but applies to higher level classes as well. Students will be entering the classroom from all different types of high schools and previous learning environments, and this will affect the way they react in a college classroom. In higher level classes, students will have had different instructors and a different experience up to the point where they enter the class, and so will react to things differently. While an instructor can try to ask questions of their students to get at this information, but there is no accurate way to predict the amount of prior knowledge before a class starts. It is up to the instructor to analyze how things are going in the class and react accordingly to adapt to the particular set of students they have.

The considerations that arise indirectly related to the course content connect to the diverse backgrounds of the students that have arrived in your classroom. Math is math, no matter who you are, and so issues related to things like race and gender shouldn't really come up. However, people are still people, and the diversity issues that arise in other disciplines still show up in math because of it. These can show up either in student-student interactions, or in teacher-student interactions with the way material is presented. For the second one, instructors using a metaphor to describe a situation in class can alienate students who do not have the same background as the instructor and do not understand or relate to that metaphor. One of the largest issues that is especially prominent in math classes (and all of STEM) is that traditionally under-represented students in these fields do not feel like they belong in the class, and this can be amplified when an instructor says or does something in the classroom that emphasizes a type of normativity which that student does not identify with. This is still an issue in math classes, and instructors need to find a way to address it to make sure that everyone feels welcome in the class and can succeed to the best of their ability.

I have gained many enlightening experiences in diverse classrooms both at Rutgers and during a summer at a middle school in Detroit, and have tried to develop strategies to reach and accommodate diverse learners of all types. I have mixed different types of learning in my classroom, including lecturing, active learning, and group work, to attempt to work with all types of students in my classrooms. Within the last few summers, I have also tried to include a peer teaching component to my classes to help students with self-efficacy, believing that they can succeed and prosper in my class. The goal of all of this is to make sure that all students have a place and belong in the classroom, so that they will be free to learn, grow, and tackle what ever confronts them, in this class and beyond.

3 Selected Course Summaries

3.1 Summer 2017 - Math 244

During the summer of 2017, I taught a section of Rutgers' Differential Equations class for engineering majors. This is a 4-credit class that all engineering majors need to take before they get into the bulk of their major-specific classes. I decided to move the class to more of an 'active learning' format, and did so by running the section as a flipped classroom because I felt this would help the students understand the material better. I recorded video lectures for the entire class, and students spent the in-class time working on problem sets in groups, presenting problems to the rest of the class, or taking quizzes.

The goal in running the class this way was the same as the motivation for most flipped classrooms: students learn math concepts best by working problems, and this format gives them time to work on the homework-type problems in class, where I can fix any issues in understanding before they spend too much time doing problems incorrectly. By giving them this time to discuss things both with their classmates and with me, I had hoped to help them understand that things in this class were not too challenging, and it was something that they all could do. Overall, this class was successful. My experience in the class and student feedback seemed to indicate that some of the groups really enjoyed the format and took advantage of the time they were given to work on problems and did very well in the class. Some of the comments I received on the course were

- "The teaching style of this class was great for *actually learning* the material and understanding it."
- "He has reinvigorated my *passion* for the subject"
- "I like the structure of the class. It is very different than the other calc classes I have taken at Rutgers. The way this class is set up encourages learning in a great new way. All math classes at Rutgers should be taught in this way. Active collaborative learning is the best!"

On the whole, I saw a lot more ownership of the material in this class than I had seen in my previous classes, and I think it helped with some of the students being more confident in their ability to tackle math classes and problems in the future, but I also learned things about teaching a class like this that would help me to improve my future classes.

3.2 Summer 2018 - Math 252

One of the most common feedback comments I received from that class was my Summer 2017 I should lecture at the start of each class on top of the videos that the students had to watch before class. I took this feedback into consideration when designing my summer 2018 Differential Equations class, where I knew that I still wanted to use some of the active learning ideas that I had developed the previous summer, but also wanted to modify the course to make it better. In order to do this, I removed the video component of the course and added in condensed mini-lectures at the start of each section of material.

Due to the format of the course, this resulted in two mini-lectures each class day, with time between them for the students to work on problems from the section that I had just talked about. At the end of each problem session, the students would have to write up the solution to one problem from that section to turn into me that I would grade. I encouraged the students to work in groups during the problem set portions of the class and I think the atmosphere of the class and the amount of things they needed to turn into me made them more likely to actually participate. Within these groups, I saw the peer teaching that I was hoping to inspire develop on its own. Students would talk to each other and discuss their answers instead of asking me questions, and became more self-reliant in that way, trusting themselves and their groups to come to the correct answer instead of needing help or approval from the instructor. Student comments showed that they enjoyed this format:

- “I really enjoyed the active learning activities that we did. [...] helped reinforce what we learned and helped me have a better sense of what problems I understood and which I needed to review again.”
- “I liked the active learning aspect of the course, I felt like being able to do the problems in class let me figure out what I really needed to work on and what I knew.”
- “So many ways. I want to be a high school math teacher so every class I take I’m always learning classroom management and teaching techniques from the teacher even if it isn’t an education class. This class deepened my love of calculus and my want to be a teacher...”

I also encouraged peer instruction specifically with several activities in the course, including a Jigsaw-type activity, where the students were broken up in to groups, and each group had a distinct problem to work on. After all the groups were done, the groups were reshuffled so that each new group had one person in it that knew each problem, and they had to explain their solutions to the rest of the group. This helped to encourage students to discuss their work with each other throughout the course as a whole, and the need to explain things to someone else helped them to solidify that they could do these problems and they did understand this, and so they were able to succeed in a traditional exam setting, and would be able to take this confidence with them into future classes and their future career.

3.3 List of All Courses

During my time as a graduate student, I have both taught and been a teaching assistant for many classes. Below is a list of these courses. More details about all of these assignments and different activities that I have designed for all of them are available upon request. This information is also available on my website <http://sites.math.rutgers.edu/~mpc163/teaching.html>, which also contains several supplements to this teaching portfolio. My full teaching record can be found at http://sites.math.rutgers.edu/~mpc163/Files/Teaching_Portfolio_Full.pdf.

3.3.1 Teaching Assignments

1. Summer 2015 - Math 251 - Multivariable Calculus for 23 students
2. Summer 2016 - Math 477 - Mathematical Theory of Probability for 24 students
3. Summer 2017 - Math 244 - Differential Equations for 25 students
4. Summer 2018 - Math 252 - Elementary Differential Equations for 26 students
5. Fall 2018 - Math 104 - Introduction to Probability for 23 students

3.3.2 Teaching Assistant Assignments

1. Fall 2014 - Math 135 - Calculus 1 Recitations for 90 students
2. Spring 2015 - Math 251 - Multivariable Calculus Recitations for 78 students
3. Fall 2015 - Math 251H - Multivariable Calculus (Honors Section) Recitations for 36 students
4. Spring 2016 - Math 575 - Numerical Methods in Partial Differential Equations (Math Finance Program) Grader for 25 students
5. Fall 2016 - Math 501 and 503 - Graduate Real and Complex Analysis Problem Session Leader for 12 students
6. Fall 2017 - Math 421 - Advanced Calculus for Engineers Teaching Assistant At Large for 169 students
7. Spring 2018 - Math 574 and 575 - Numerical Analysis 2 and Numerical Methods in Partial Differential Equations (Math Finance Program) Recitations for 40 students

4 Teaching Development Activities

4.1 Directed Readings Program

The Directed Readings Program at Rutgers provides an opportunity for motivated undergraduate students to explore topics outside the normal undergraduate curriculum in an independent study format. The leaders of these projects are graduate students, and pairings are made between undergraduate students and graduate student volunteers based on a survey that the undergraduate student completes when requesting to be enrolled in the program.

The general outline of the program is that during the first few weeks, the pair settles on a project that both the undergraduate is interested in and the graduate student has some knowledge in. After that, they meet for around 1 hour per week, talking about the topic, and the undergraduate student is expected to do around 2 to 3 hours of work on the project per week outside of the meetings. At the end of the semester, the undergraduate gives a 15 minute presentation on what they learned over the course of the semester.

I have had the privilege of working on 5 of these projects with fantastic undergraduate students. The topics of these projects were:

1. Schrödinger equation: Deriving and solving a model of the Hydrogen atom
2. Fourier Analysis: Introduction to Fourier Series and the Gibbs Phenomenon
3. Functional Analysis: Banach and Hilbert Spaces and the δ -function
4. Markov Chains: What are they, and how can they be applied to the Travelling Salesman Problem.
5. Fourier Analysis Round 2: Introduction to Fourier Series and Fourier Transforms

4.2 Teaching Communities

Outside of these math classes that I have taught while at Rutgers, I have also been involved in and sought out other teaching-related activities that have helped me to develop as an instructor. Within the math department, I have been a central component of the revival of the Mathematics Teaching Group, where a group of graduate students get together once a week for discussions about teaching and pedagogy. In recent years, we have also added students from the Math Education program to our group who have helped to give us more of the education background and the proper framework in which to discuss these topics. The discussions have covered everything from dealing with instructors as a TA, academic integrity policies, and inquiry-based learning, to potential ways to reform our calculus sequence at Rutgers.

Outside of the math department, I have been involved with the Rutgers Academy for the Scholarship of Teaching and Learning for the last three years, which brings graduate students together from many different departments to

discuss teaching issues and how they arise in their different disciplines. Getting to hear from a variety of graduate students and fields has helped me to understand the broader scope of education and given me the opportunity to have these discussions that would never have happened otherwise, and they helped me to generate new ideas for how to handle a classroom. I also helped to run several of these sessions, discussing topics like ‘Engaging Students and Managing Discussions’ and ‘Classroom Expectations’.

In addition, I became involved with the Active Learning Community at Rutgers, which meets several times a year to discuss topics including active learning practices, how to implement them in the classroom, and how to convince people that they should try out active learning. This group has been a great resource for me as I looked to develop my own active learning style and activities for my summer classes, and I know the experience I gained with them will help me in future course design and preparation as well.

4.3 Teaching Awards, Honors, and Presentations

During Spring 2018, I was given the TA Excellence Award from the Mathematics Department. This is given to two graduate students in the math department every semester in recognition of outstanding performance in undergraduate teaching, generally given to more senior students in commendation of their work over their entire graduate career.

The previous semester, in Fall 2017, I was given the honor of presenting a talk at the first annual NE RUME (Northeast Research in Undergraduate Mathematics Education) conference at Montclair State University. I gave a presentation entitled “Flipped Classrooms for Higher Level Mathematics,” detailing my experiences with my flipped version of differential equations that I taught the previous summer. In addition to talking to many other motivated educators about my experience, I also got valuable feedback from them on what could potentially be done to improve the class for future iterations.

I also ran several presentations with the Rutgers TA Project, which puts on workshops on a variety of topics that graduate students from all over Rutgers can attend to learn more about different teaching ideas. Topics of workshops that I have helped to coordinate range from ‘Teaching a Summer Course’ and ‘Teaching Non-Majors’ to ‘Providing Feedback that Matters’ and ‘Integrating Instructional Methodologies.’ In addition, in Fall 2018, I was given the great honor to be an invited guest on the newly-formed TAPCast, a podcast run by the TA Project discussing teaching pedagogy and other issues. My episode featured myself and Sandra Medina from the Spanish department talking about our different experiences with active learning in the classroom. I talked about the two classes I had taught in Summer 2017 and 2018 and what I had gained from them in terms of active learning.

4.4 Administrative Roles

4.4.1 TA At Large Coordinator

In the Fall of my 4th year at Rutgers, I was assigned a role as a TA-At-Large (TAAL) for the semester. Part of this assignment was to hold both in-person and online office hours, and the online ones generally took place in a single room in the math building. I had been working to schedule my office hours, when it became clear to me that no one in the department was actively doing anything to get these courses set up. When I discovered that, I decided to take on this task and get the program set up myself.

The duties for being the *de facto* TAAL coordinator consisted of contacting all of the other TAALs to have them provide me with their rosters so that the students could be added to the corresponding online course. I was also in contact with the technology staff to help decide what platform we were going to use for the semester, as well as to provide them with the roster data and the information from the corresponding TA who needed access to be able to run the session. I helped to organize the training sessions, where new TAALs would be shown how to use the online platform, and scheduled the online office hours because all of the 12 TAs for the courses needed to use the same room for their sessions, and I served as the go-between for the TAs and the technology staff to make sure that everything worked out for both parties.

When the same problem arose at the start of the following Spring semester, a lot of the TAALs came to ask me what the situation was, because no one else had any information on how this program worked. Since the classes needed to get up and running, I took charge of the program again that semester, coordinating between the TAs and the technology staff to make sure the office hours happened, even though I was not a TAAL that semester. In order to shift these duties off of me before the following Fall semester, I prepared a document outlining the process of getting the online office hours started and passed that on to the Undergraduate Vice Chair. The hope of this was that the department would know what the process was and that which ever faculty member was assigned to this task would know how to do it as effectively as possible.

4.4.2 Summer Head TA

For the summers following my third, fourth, and fifth years as a graduate student, I served as the Head TA for the summer session. The role of the Head TA is to serve as a mentor for all of the graduate students who are teaching over the summer. Before classes start, we meet with graduate students, particularly those who had not taught in the past, in order to discuss their syllabi and how they plan to run the course. Once classes have started, we go around to observe all of the graduate student instructors and give them feedback on their teaching, meeting with them a few days later to discuss what we saw. While the feedback from the Head TA doesn't get recorded anywhere permanent, the goal of it is to help the graduate student improve their teaching before their official observation happens later in the summer. We also serve as a resource to

all of the other graduate students for anything they would like to discuss about teaching or any issues that arise in their classes.

I feel like this position was a great experience, not only in that I was able to help out many other students in my department, but that I got to observe so many other students teaching, all of whom had a different approach to their class than I did. When I went to observe students, I took notes on what they were doing in class, not only to give them feedback later on, but also to remember the good things they did that I could potentially add to my own class. It also put me in direct contact with the other graduate students who cared about teaching and allowed us to combine and discuss ideas for classes, helping all of us to get better at it for future summers and future jobs. My summer classes have steadily gotten better not only because I have improved as a teacher, but also because I have had this opportunity to observe and discuss teaching practices with a large range of graduate students during my time as the summer Head TA.

Other Information

More information on any of these programs or classes is available upon request. If you would like the full information on all of these classes, it is available on my personal website sites.math.rutgers.edu/~mpc163 or you can go directly to my full teaching portfolio at http://sites.math.rutgers.edu/~mpc163/Files/Teaching_Portfolio_Full.pdf.

You can also reach out to me at any time at charnley@math.rutgers.edu, and I can provide any specific information you would like. This includes sample course materials, full course evaluations, and more detailed reflections on all of these classes and programs.