Teaching portfolio

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1. Teaching philosophy statement

My mentors in college and graduate school have been faculty who inspired me to be curious and learn more. In college, these professors taught me how to effectively communicate and contribute in classes while adjusting as an international student. Reflecting on my course experiences helped me realize what made them excellent instructors: they motivated new concepts with many examples, they chose appropriate assignments to test understanding and further learning, and they provided ample space for student questions and interaction. As a result, they helped promote my learning and encouraged me to further my knowledge in the mathematical sciences and beyond. My goal is to instill the same inspiration in my students.

My mentors' approach to teaching influenced the way I co-taught a summer session undergraduate course on systems of differential equations and partial differential equations, where I was responsible for giving lectures, creating all course materials and exams as well as grading assignments. This class was an opportunity for me to use principles of backwards design, so that I created class materials only after reflecting on key learning outcomes and evidence of outcome achievement in students. A year-long Certificate for Reflective Teaching at the Sheridan Center for Teaching and Learning at Brown was very helpful in familiarizing myself with this effective class design. I also used the students' responses in each class and performance on each assignment as an ongoing guide for my teaching. Students' insightful questions during our lectures prompted us to re-design parts of future lessons and problem sessions. For instance, one of their questions motivated me to include an exploration of Hermitian matrices in a problem session (see sample on page 13). This helped me introduce concepts that the entire class could benefit from learning. I strongly believe that inviting student participation in this way is essential in their learning, as I have discovered by being a teaching consultant for graduate students and postdocs at Brown through the year-long Teaching Consultant Certificate. I find that when they are invited to interact, students are more engaged and more likely to find the class enjoyable, which is one of my main objectives for a course.

My goal in teaching applied mathematics courses is that students who come in with very different backgrounds and interests come out with an appreciation for applied mathematics. I aim to get to know my students' interests and use it in constructing my courses as much as possible. In the differential equations summer course I co-taught, I worked with my co-instructor to organize a lunch on the Main Green for the 11 students in our class. This was an excellent way to learn about their interests within their concentrations, and to talk to them about our experience with research in applied mathematics. Students' interest in engineering applications prompted us to frequently complement our lectures and problem sessions with demos and software tools. For example, I taught students how to use a numerical tool that helped visualize phase plane analysis concepts highlighted in class (see sample on page 16). I noticed that this encouraged discussion on class material, and gave students the desire to test the provided simulation resources. During class, I also made an effort to link concepts to my or other research, so as to expose students to the relevance and usefulness of applied mathematics topics in current research.

Many students need to hear explanations of concepts repeatedly and in more than one way, and I believe this is a key ability in a good instructor. I like mentioning during class that some concepts are particularly challenging, and present a few ways of approaching the topics that have helped me understand it. One student in the 80-person differential equations and applications class I was a teaching assistant for wrote that they found my approach "very helpful in explaining difficult concepts that I did not fully understand from class". In a different teaching assistantship for a 200-student probability and statistics course, bringing up my experience and using humor along the way helped ease the students' anxiety as they were trying to master difficult concepts in office hours. I have found that this is especially effective with students from groups that are often underrepresented in mathematics and sciences, as it made them better able to relate to the experience. For this reason, I am involved with the Association for Women in Math at Brown, where I have been on panels on research opportunities and joined a mentoring program for women undergraduate students interested in mathematics. Explaining material in multiple ways has also been effective in my volunteering experience with "English for Action", where I teach beginning math topics to non-traditional immigrant learners in Providence seeking their high school diplomas.

An important learning outcome I set for my students is that they are able to identify the mathematical tools needed in problem solving, as well as interpret their results. Moreover, it is important to me that students can articulate and argue why a certain approach is needed. In the summer differential equations class, I created assignments where students were not only given ample opportunity to practice class concepts, but also to comment on the meaning of their solutions. For example, a homework assignment was built around a susceptible-infectious-removed model of disease spread (see sample assignment on page 15). Questions on mathematical concepts such as critical points and stability were complemented by questions on what their analysis predicted in the context of disease spread. This allowed me to assess the students' grasp on both mathematical techniques and result interpretation, and prompted a student to write in their evaluation: "A couple of the homeworks helped add context which got me to think more about how I could actually use the things I learned."

To achieve the learning outcomes of a mathematics class, I believe practice assignments that involve group work are essential in getting students engaged with the material. For the differential equations course I taught, I used worksheets that consisted of parts of board exercises or examples of concepts just introduced. Students worked on these sheets in pairs, and reported finding them extremely helpful. One student wrote in the course evaluation that the "method of doing problems in class step-by-step was an effective way for me to absorb and understand the materials". In addition to this, we collaborated with the Center for Teaching and Learning at Brown to hold recitations as group problem sessions graded for completion. We designed these sessions to include extensions of material presented in class, applications, proofs of important concepts and demos to visualize them. We allowed students to discuss the problems with their group members, and we moved between different groups to identify the difficulties students encountered. I find that students at all levels find it exciting to work on problems that go beyond class material in a team, and to discover connections to other classes (as proven by statements such as "It all comes together!"). In a summer research program, I encouraged the two undergraduate students working with me to learn from each other's strengths. As a result, they worked through project challenges together. They succeeded in developing new methods to extend data from networks of social interaction and in evaluating disease transmission on dynamic graphs.

In all teaching settings, I strived to enforce key learning goals such as identifying and applying needed mathematical tools for solving a given problem, and interpreting the meaning of results. In any future teaching opportunities I am presented with, I hope to inspire students to appreciate the value of mathematical techniques and to apply this knowledge in future projects. In this way, I hope to enable students' learning and problem solving just as my mentors did for me.

2. Teaching experiences

2.1 Undergraduate courses taught

2.1.1 Methods of Applied Math II, Brown University, Summer 2015

In this undergraduate summer session course, I covered systems of differential equations and an introduction to separation of variables for solving partial differential equations. I engaged students with the concepts through applications from physical and biological sciences. The course format included lectures and mandatory group recitation sessions. The 11 students attending the class were concentrators in applied math, engineering and sciences and were in their second or third year at Brown.

As a co-instructor for this course, I taught half of the lectures, ran weekly recitations and office hours, ran exam review sessions, created the syllabus and half of the class notes, created assignments, exams, class worksheets, programming tutorials and recitation problem sheets, and graded assignments and exams.

2.2 Teaching assistant positions

2.2.1 Statistical Inference I, Brown University, Fall 2013

As a teaching assistant for this course, I was in charge of weekly recitations and twice weekly office hours, held exam review sessions, made suggestions for exam and review problems, and graded the assignments and exams.

This undergraduate semester course covered an introduction to probability and statistics. The course format included lectures and twice weekly recitation sessions. There were more than 200 students in the class, spanning various concentrations and class years.

2.2.2 Methods of Applied Math I, Brown University, Spring 2014

As a teaching assistant for this course, I facilitated twice weekly group work recitations and weekly office hours, held exam review sessions and graded the assignments and exams.

This undergraduate semester course covered ordinary differential equations, elementary numerical methods, Laplace transform for initial-value problems and applications. The course format included lectures and twice weekly recitation sessions. There were more than 70 students in the class, spanning various class years and concentrating in applied math, engineering or other sciences.

2.3 Other teaching experiences

Guest lectures, Brown University:

- Methods of Applied Math I, Spring 2014
  Lecture on series solutions for differential equations: used instructor's notes and complemented with examples.
- Topics in Chaotic Dynamics, Spring 2015
  Lecture on fractals, with definitions, examples, and dimension calculations: used instructor's outline and complemented with proofs, examples and slides.

English for Action (EFA), Providence, Rhode Island:

EFA is a learning community aimed at helping the immigrant population in Rhode Island obtain their high school diplomas though the National External Diploma Program (NEDP). Since Fall 2014, I have volunteered to facilitate a weekly beginning mathematics class for 5-15 learners of all ages. For this class, I am in charge of deciding and creating the lecture material, as well as choosing assignments and class worksheets.

Math CoOP, Brown University:

I am a part of the Math CoOP, a group of students, postdocs and faculty interested in mathematical outreach. As part of this program, we meet monthly to discuss and practice new ideas for mathematical presentations. I have created and given a lecture on fractal properties and applications to about 15 high school students in Boston during the summer program Young Leaders in STEM (part of the Science Club for Girls at MIT).

Research Experience for Undergraduates (REU) lecture and Group meeting, Brown University:

I have given a lecture on static network properties and a lecture related to my thesis research on analyzing systems of partial differential equations to about 10 undergraduate students during an REU at Brown in Summer 2015.

I also participate in Dr. Bjorn Sandstede's group meeting, where I give a lecture presentation every semester to the interested graduate students and postdocs in attendance on a topic related to the semester research theme.

3. Sample course materials

3.1 Sample course syllabus

APMA 0340: Methods of Applied Math II

Applied Math (APMA) 0340
Fall 2015
Wilson Hall 309
Mon Wed Fri, 1:00 - 1:50pm
Canvas Homepage: https://canvas.brown.edu/courses/977196

Instructor: Veronica Ciocanel

Contact info:

- **Office:** Room 209, 170 Hope Street
- **Email:** veronica_ciocanel@brown.edu
- You may expect to receive responses to email inquiries in less than 24 hours.

Office Hours: Wednesdays 3:30-5:30, and by appointment.

Recitation session: Wednesday and Thursday 4:00 - 4:50pm in ETC Teaching Lab in CIT 201. Participation in one of the recitation sessions is strongly recommended.

I **Course Description:**
APMA 0340 is an introduction to mathematical techniques involving differential equations used to model physical and biological phenomena. Applications and selected theoretical foundations of the covered techniques will be discussed. This is the second class in a two-course sequence on Methods of Applied Math, which is typically required for students in Applied Mathematics and Engineering. APMA 0330 or 0350 (or instructor approval) are prerequisites for this course.

II Course Goals and Outcomes:

Goals:
Students will be able to apply broadly-used mathematical models and analyze them through differential equations techniques. They will learn to engage in critical reading of relevant scientific articles, and they will be able to collaborate to solve complex mathematical problems. At the end of the course, students will be able to interpret the physical and real-world meaning of the models and differential equations studied.

Learning Outcomes:
By the end of the course, students will be able to:

- Perform basic matrix algebra
- Identify and solve systems of linear algebraic and first-order differential equations
- Analyze and construct phase portraits for systems of ordinary differential equations
- Linearize and analyze stability of systems of ordinary differential equations
- Apply the above concepts to problems in biology and physics
- Calculate Fourier series expansions
- Use Fourier series and separation of variables to solve certain fundamental partial differential equations
- Engage with scientific articles related to applications of the concepts explored in class
- Understand the physical and real-world interpretation of the methods studied

III Course Materials:

Elementary Differential Equations and Boundary Value Problems [10th edition]
W.E. Boyce and R.C. DiPrima, published by John Wiley & Sons Inc.
Obtaining the textbook is recommended.

IV Course Requirements:

- Homework will be assigned weekly and will be posted online on Canvas on Thursday. Homework assignments will be due every Wednesday at the beginning of class. These problems will include practice exercises for the week's topics, as well as application problems to test understanding and interpretation of results from the mathematical analysis. A few homework problems may include short write-ups on scientific articles relevant to the class topics.
- There will be two in-class midterm exams on February 23rd and April 9th (tentative dates). The final examination for the course is scheduled for Thursday, May 8th 2-5 pm, and will be cumulative (meaning that it will test material from the entire course).
- Attendance of the recitation group problem sessions is optional, but highly recommended as it will provide additional practice of the class concepts, and more in-depth material coverage through short proofs and application problems. This will give students a chance to collaborate on solving mathematical questions in groups of three members.

V Grading Policy:

Graded work	Weight
Homework	20%
Midterm exam 1	25%
Midterm exam 2	25%
Final examination	30%

Provisional grading scheme

Grade	Percentages to aim for
A	90 - 100%
B	80 - 89%
C	70 - 79%

The class may be taken pass/fail. In order to pass, students must aim for a 70% or more average grade in the course, and must not miss the final examination. Students will be awarded pass with distinction if they average 90% or more in the course. Note that the above grading scale is in accordance to the Brown University Grading System.

The grading scale above is subject to adjustment, especially in borderline cases; adjustments may take into account class and recitation session participation and improvements in performance over the semester. Minimum percentages for grade cut-offs will be approximately as (and no higher than) in the tentative scale above.

Plagiarized homework assignments will receive an automatic penalty grade of zero points.

VI Policies and Expectations of Students:

Homework:

- Homework assignments will be posted online on Canvas every Thursday. Assignments will be due Wednesday at the beginning of class.
- Late homework assignments will not be accepted, as they cause considerable inconvenience for the instructors. No credit will be given for late work unless students provide a legitimate excuse (illness/emergency), together with verification.
- Students can collaborate on homework assignments, and can check answers with classmates. However, assignments must be written up separately and individually.

Exams:

- Exams will not be given for individuals at times other than the scheduled slots, except in cases of illness, emergency or some other urgent situation; documentation verifying the excuse will be required, such as a note from your doctor. You must contact me as soon as you can, before the exam whenever possible, if a serious conflict arises.

Recitation sessions:

- Recitations will consist of problem sessions, where students will be divided into 3-person groups and work on practice problems or applications related to the concepts introduced that week.
- Attendance of one of the recitation sessions offered each week is optional, but highly recommended. It will provide extra preparation for assignments and exams, push your knowledge further, as well as help you make friends in the class.
- You are expected to work on the problems with your group, and encouraged to use the individual board or pad available to your group. You should make sure you understand all steps of the problems that you solve with your group.

Software:

- For any work that requires the use of software such as Matlab or Mathematica, students may use their personal laptops or the computers available in the ETC Teaching Lab.
- Tutorials for these programs will be available on Canvas in advance of the problem sessions or assignments where they might be useful or needed.

VII **Special Considerations:**
APMA 0340 covers roughly the same material as APMA 0360. Students who have declared their Applied Math concentration are strongly encouraged to consider taking APMA 0360 for a more rigorous coverage of the mathematical techniques in the course.

VIII **Accommodations for Students with Disabilities:**
Brown University is committed to full inclusion of all students. Students who, by nature of a documented disability, require academic accommodations should contact the professor during office hours. Students may also speak with Student and Employee Accessibility Services at 401-863-9588 to discuss the process for requesting accommodations. Visit Student and Employee Accessibility Services (SEAS) for more information.

IX **Academic Support:**
TA Office Hours will be posted on the website. You are encouraged to take advantage of this resource available for the class.
The Math Resource Center hours are available at https://www.math.brown.edu/mrc/.

X **Inclusivity or Diversity Statement:**
Brown University does not discriminate on the basis of sex, race, color, religion, age, disability, status as a veteran, national or ethnic origin, sexual orientation, gender identity, or gender expression in the administration of its educational policies, admission policies, scholarship and loan programs, or other school administered programs.

I intend to support an inclusive classroom environment where diverse perspectives are recognized, respected, and seen as a source of strength.

XI **Academic Honesty:**
Consult http://www.brown.edu/academics/college/degree/policies/academic-code.

Course Content

Topic	Section
Systems of First Order Linear Equations	
Introduction to Systems of First Order Linear Equations and applications	7.1
Review of Matrices	7.2
Linear Algebraic Equations; Linear Independence, Eigenvalues, Eigenvectors	7.3
Basic theory of Systems of First Order Linear Equations	7.4
Homogeneous Linear Systems with Constant Coefficients	7.5
Complex Eigenvalues	7.6
Repeated Eigenvalues	7.7
Fundamental Matrices	7.8
Midterm exam 1: February 23rd, in class	
Nonlinear Differential Equations and Stability	
The Phase Plane: Linear Systems	9.1
Matlab and Pplane tutorials	
Autonomous Systems and Stability	9.2
Locally linear Systems	9.3
Competing Species	9.4
Predator-Prey equations	9.5
The Lorenz Equations and other applications	9.8
Midterm exam 2: April 9th, in class	
Partial Differential Equations and Fourier Series	
Two-Point Boundary Value Problems	10.1
Fourier Series	10.2
Even and odd functions	10.4
Separation of Variables; Heat Conduction in a Rod	10.5
The Wave Equation	10.7
Other Heat Conduction and Wave Problems	10.6
Final exam: May 8th, 2-5 pm, in class	

3.2 Sample class worksheet

A sample problem from a class worksheet used during a lecture on the method of separation of variables, which provided further practice:

Wave equation - nonzero initial velocity

Consider the wave equation problem with nonzero initial velocity:

$$u_{tt} = a^2 u_{xx}, \tag{3.1}$$

on $0 \le x \le L$, $t \ge 0$, with boundary conditions

$$u(x = 0, t) = 0, \qquad u(x = L, t) = 0 \qquad \text{for } t \ge 0$$

and initial conditions

$$u(x, t = 0) = 0, \qquad u_t(x, t = 0) = g(x) \qquad \text{for } 0 \le x \le L.$$

You will solve this problem in your group using separation of variables in a similar manner as we solved the wave equation problem with nonzero initial displacement in class.

1. Substitute $u(x,t) = X(x)T(t)$ into the problem above. Make sure to note any changes from the class problem - you can expect a change in the initial condition for T.

2. Solve the separated x-problem. Are there any changes from the class problem?

3. Solve the separated t-problem. Are there any changes from the class problem?

4. Write out the general solution as an infinite series. What do you need to do in order to use the second initial condition given?

5. Check the answer for the previous question with your instructor, and find the solution of the problem.

3.3 Sample group problem session

A sample problem from a group problem session/recitation (groups of three students work on the problems at their own pace, and discuss their results with the instructor at the end of each problem):

Problem 1

In class, we only looked at solutions of equation $\boldsymbol{x}' = A\boldsymbol{x}$ for A a real-valued matrix. In this problem, we examine what happens in the case of a specific type of complex matrix.

A square matrix A is called **Hermitian** if $A = \bar{A}^T$ (in other words, if it equals the conjugate of its transpose). This is usually denoted as $A = A^*$. Note that $(AB)^* = B^*A^*$, and $(A\boldsymbol{x})^* = \boldsymbol{x}^*A^*$.

1. What properties does a Hermitian matrix with real entries have?

2. If a Hermitian matrix has complex entries, what can you say about its diagonal elements?

3. In this part, we will prove that all eigenvalues of a Hermitian matrix are real.

   (a) Start with the definition of an eigenvalue-eigenvector pair:

   $$A\boldsymbol{v} = \lambda\boldsymbol{v}. \tag{3.2}$$

   Apply * to both sides of this equation, then multiply the right of both sides by $\boldsymbol{v}$.

   (b) Use the fact that A is Hermitian: $A = A^*$ and equation (3.8) to simplify your result from part (b).

   (c) Conclude that $\lambda = \lambda^*$ and discuss with this group what this suggests about the eigenvalues of a Hermitian matrix.

It can also be shown that a Hermitian matrix A must have a full set of linearly independent eigenvectors.

4. Let
$$H = \begin{bmatrix} 1 & 2+i \\ 2-i & 5 \end{bmatrix}.$$

   (a) Verify that matrix H is Hermitian.

   (b) Find the eigenvalues and eigenvectors of matrix H.

   (c) Discuss any observations with your group.

   (d) Write down the general solution of $\boldsymbol{x}' = H\boldsymbol{x}$.

Have someone in your group explain what this problem suggests about solving $\boldsymbol{x}' = A\boldsymbol{x}$ where A a Hermitian matrix.

3.4 Sample homework assignment

A sample problem from a homework assignment aimed to test understanding of critical points and stability, as well as interpretation of results for the biological problem:

Problem 1

In this problem, you will analyze a model of disease spread in a population (the SIR model). These equations model the spread of an endemic disease that confers immunity. The variables in the model represent individuals that are susceptible to the disease (S), infected by it (I), or recovered/removed (R). $N = S + I + R$ is the total number of individuals in the population.

The equations are as follows:

$$\frac{dS}{dt} = \mu N - \beta SI - \mu S \tag{3.3}$$

$$\frac{dI}{dt} = \beta SI - (\gamma + \mu)I \tag{3.4}$$

$$\frac{dR}{dt} = \gamma I - \mu R, \tag{3.5}$$

where $\mu > 0$ is the population birth and death rate, $\beta > 0$ is the transmission rate and $\gamma > 0$ is the rate of recovery from the infection.

(a) Calculate $\frac{dN}{dt}$ and conclude how the total population varies with time.

(b) Let $s = \frac{S}{N}$ and $f = \beta I$. Show that the differential equations in s and f become:

$$\frac{ds}{dt} = \mu(1 - s) - sf \tag{3.6}$$

$$\frac{df}{dt} = (\gamma + \mu)f(R_0 s - 1), \tag{3.7}$$

where $R_0 = \frac{\beta N}{\gamma+\mu}$ is the "basic reproductive rate" of the disease. Note that s is the fraction of susceptibles in the population, and f is a measure of the force of the disease.

(c) Find the critical points of the system found in part (b). Your answer may depend on the parameter R_0.

(d) What does each critical point mean in the context of the disease?

(e) Determine the stability of the critical points.

(f) What do you conclude about the effect of R_0 on disease spread as predicted by this model?

3.5 Sample numerical tool tutorial

A part of a sample tutorial aimed to familiarize students with a Matlab tool that helps visualize and enforce concepts such as phase planes and stability of critical points:

Phase portraits with pplane8

Download the script *pplane8.m*, which has been developed by John C. Polking at Rice University, from the Canvas page (*Files/Resources*) and save it on your computer. Start Matlab and change your working folder to the folder in which you saved *pplane8.m*. Next, type "pplane8" in Matlab: the Setup window will pop up in which you can enter differential equations in the plane and any parameters that appear in these equations.

Now suppose we want to look at the phase portrait for Example 7 considered in class:

$$\boldsymbol{x}' = \begin{pmatrix} 7 & 1 \\ -4 & 3 \end{pmatrix} \boldsymbol{x} = \begin{pmatrix} 7x_1 + x_2 \\ -4x_1 + 3x_2 \end{pmatrix}. \tag{3.8}$$

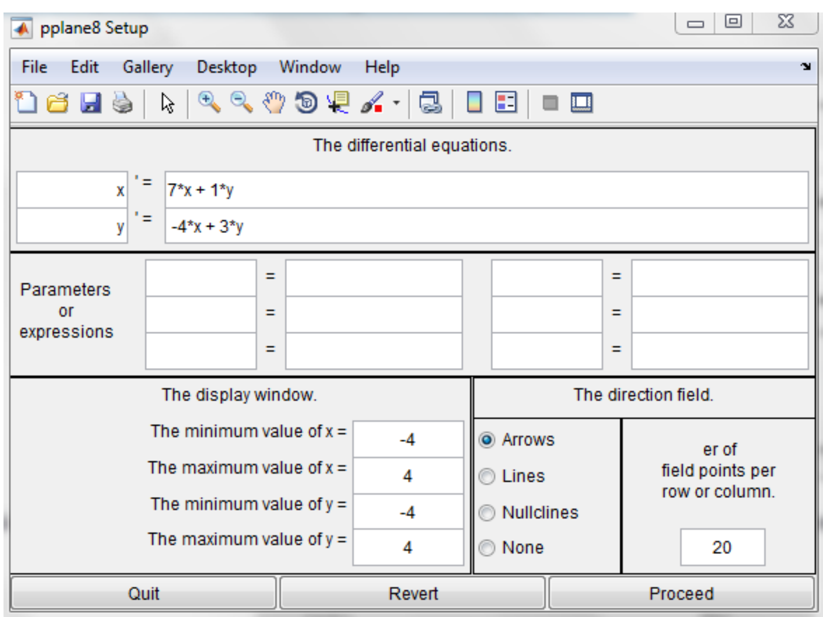
In *pplane*, the variables have the different names

$$x = x_1\,,$$

$$y = x_2\,.$$

Type the equation for x_1' in the x' field, and the one for x_2' in the y' field. You can also set the minimum and maximum values for x and y, which correspond to how long the x and y axes will be when displayed. You can set a parameter, such as α instead of 7 in the first differential equation, and vary the value of α in the parameters box.

To save the differential equations into your working folder, choose "File → Save the current system" from the menubar, which allows you to reuse your equations later by selecting "File → Load a system...".



Clicking on "Proceed" will take you to a window with the phase portrait of our differential equation.

4. Training and activities to enhance pedagogy

4.1 Training through the Sheridan Center for Teaching and Learning

4.1.1 Certificate I: Reflective Teaching Seminar, 2013-2014

This introductory certificate on Reflective Teaching consisted of monthly lectures and workshop discussions on topics such as developing student learning goals, syllabus design, assessment and evaluation, and persuasive communication. Through this certificate program, I improved my teaching and assessment strategies, as well as communication skills in teaching settings. I was observed while leading an undergraduate probability recitation session and received feedback on how to better achieve my teaching goals.

4.1.2 Certificate IV: The Teaching Consultant Program, 2014-2015

During this certificate program, I received training to become a Teaching Consultant for the Brown community. In this role, I observed and provided feedback to peer instructors engaged in various teaching settings, such as large lectures, discussions sessions and workshops. Through this program, I continued to reflect on my teaching practices, and I gained experience giving constructive advice to instructors while learning from their teaching methods. As part of this certificate, I also focused on how to build an environment that promotes inclusive learning and reflective teaching.

4.1.3 Certificate III: Professional Development Seminar, 2015-2016

This certificate program provided a seminar-style space to work on and provide feedback to various components of the participants' teaching portfolios. As part of this seminar, I learned to develop a teaching philosophy statement, syllabus, CV, cover letter, as well as to effectively communicate my research findings to a non-specialist audience.

4.1.4 Applied Mathematics Department Sheridan Center Liaison, 2013-2016

From 2013 to present, I also served as the Applied Mathematics Sheridan Center Liaison. In this role, I attended meetings each semester with representatives from different departments and staff at the Sheridan Center for Teaching and Learning to discuss departmental teaching needs for graduate students. I informed the Applied Mathematics Division about the Sheridan certificate programs, as well as about new workshops or teaching orientations. In the last year, I will collaborate with the Division leadership and with the new liaisons to develop and implement a teaching assistant orientation program for graduate and undergraduate students in Applied Math.

4.2 Facilitator training through the Brown AAU STEM Education initiative

I joined the AAU Undergraduate STEM Education Initiative at Brown while I served as a teaching assistant for Methods of Applied Math I in Spring 2014. This initiative, supported by the Sheridan Center for Teaching and Learning and the Science Center at Brown, encouraged us as instructors to carry out recitations in a small group work format. As part of this initiative, I received training to become a better facilitator for the group problem sessions for both courses.

I then implemented this format with my co-instructor for Methods of Applied Math II during Summer 2015. We introduced this format for the first time in this class and created the first worksheets with problems suited for groups of three students. All problem sessions in the summer 2015 class were observed by a representative from the Science Center, who provided feedback to improve student learning. This format encouraged student participation and built a stronger community of students in the class. The inclusive format of the group problem sessions encouraged minority students to be active participants in the course.

5. Evidence of teaching effectiveness and student learning

5.1 Reginald D. Archambault Award for Teaching Excellence at Brown, Summer 2015

Together with my co-instructor, I received the **Reginald D. Archambault Award for Teaching Excellence at Brown University**. We were awarded the **1st Prize for Summer Education** for “Methods of Applied Math II”, taught during summer session 2015. As outlined on the website, “The Reginald D. Archambault Award for Teaching Excellence recognizes, rewards, and promotes excellence in teaching in the Brown University summer programs.”

Award citation: “[Name of co-instructor] and Veronica should be commended for their work and efforts in teaching APMA 0340 in the Summer Session 2015. [Name of co-instructor] and Veronica designed and implemented an incredibly detailed and comprehensive curriculum plan focused on student-centered learning. They utilized a novel approach in teaching this course and it was evident, through student evaluations, that their efforts were highly successful. The instructors articulated and incorporated three overarching goals for the students that allowed them to learn the skills associated with solving mathematical equations as well as apply the tools to complex models and place their learning in the context of real-world applications. The course focused on student-centered learning and encouraged student feedback which was immediately incorporated by the instructors in their efforts to continually enhance the course. The curriculum was creative and exciting, employed real world models and applications as applicable, encouraged successful group participation and active learning and provided an incredible experience for the students.”

5.2 Mid-semester student feedback

Two examples of mid-semester feedback from **Statistical Inference I, Brown University, Fall 2013** are provided below. I requested these in order to understand what students hoped to accomplish in office hours, and how I could adjust to better assist their learning. Their feedback prompted me to communicate more closely with the course instructor, so that I could use the same notation and conventions during office hours.

Feedback for Veronica Ciocanel

APMA 1650 : Statistical Inference I

1. What is going well in problem sessions and office hours?

Very helpful. Veronica rocks. You sent me an email responce that was more thoughtful and thorough than any that I have received. Its clear that you like what you are doing, and you are one of the most helpful TA's that I have ever had.

2. What can be improved or changed?

More material of Fourier Reconstructions of piecewise smooth functions. ... jokes.

2. What can be improved or changed?

not much... it would be nice if somehow you knew what we had/had not gone over in class (e.g. CLT)

3. What can you do better to get more out of the recitation sessions and office hours?

do problems before coming

4. Is there anything I can do to assist you better in learning the material?

Keep taking stupid questions! ☺

5.3 Course evaluations

5.3.1 Methods of Applied Math II (APMA 0340), Brown University, Summer 2015

Results of the end of the semester survey for Applied Math (APMA) 0340 are summarized in figure 5.1, and a few student quotes are included below.

"Extremely well organized and prepared during lectures. Played off of other instructor very well."

"Veronica was extremely helpful in office hours, and she did a very good job in lecture. She made sure that the students understood the steps that we were taking in the problems."

"Veronica was a wonderful instructor, with much patience and charisma. She did her best to answer individual questions, and took the learning of the course far beyond the bounds of the textbook, using Matlab and real world examples very frequently."

"I learned more in this single math course than the accumulation of all my other math courses at Brown. I developed every skill which the course syllabus outlines incredibly well."

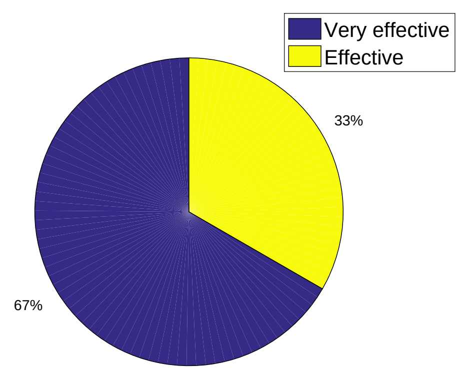


Figure 5.1: APMA 0340 Course and instructor effectiveness

5.3.2 Statistical Inference I (APMA 1650), Brown University, Fall 2013

Results of the end of the semester survey for Applied Math 1650 are summarized in figure 5.2, and a few student quotes are included below.

" Veronica was an excellent TA: she explained everything very well. She even met with me outside of class on her own time. I would wholeheartedly recommend her to other students taking the course."

"Veronica was my favorite TA as she could always break down problems. She would explain how to approach each type of problem generally and then specifically how to perform each step. She was always available and offered treats during her office hours. Her bubbly personality made going to TA hours enjoyable."

"What an amazing TA!!! She put time into her students, was always available, and really did explain things well. I felt that she really cared. Best TA I've had at Brown."

"Best TA of the course. Communicates the material very well (it sticks when Veronica explains it!) and is incredibly patient when answering questions. She rocks!"

"Veronica went above and beyond the necessary duties of a TA for such a large class and she really cared a lot about the students. She is an absolute breath of fresh air and I would have surely failed this class without her.”

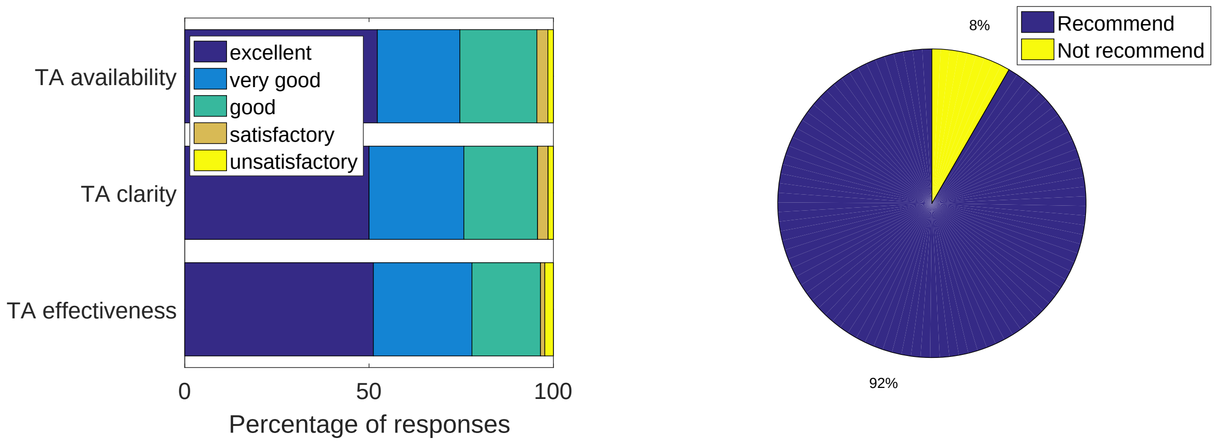


Figure 5.2: APMA 1650 Teaching assistant effectiveness, clarity and availability (left); Recommendation of TA for other courses (right)

5.3.3 Methods of Applied Math I (APMA 0350), Brown University, Spring 2014

Results of the end of the semester survey for Applied Math 0350 are summarized in figure 5.3, and a few student quotes are included below.

“Very knowledgeable, kind, and helpful. She was always quick to reply to emails, and her reviews before exams were extremely helpful. She had great clarity, and mastery of the subject.”

“She was very eloquent in her explanations and one could tell that she genuinely cared about our learning in the course.”

“Veronica was a very helpful and amiable TA, who prepared well-needed practice problems for exams, monitored recitation sections well, and taught a clear and concise lecture towards the end of the semester.”

“She was a good, knowledgeable TA and was always able to answer students’ questions.”

“Veronica was a super helpful TA that I felt I could always go to for help.”

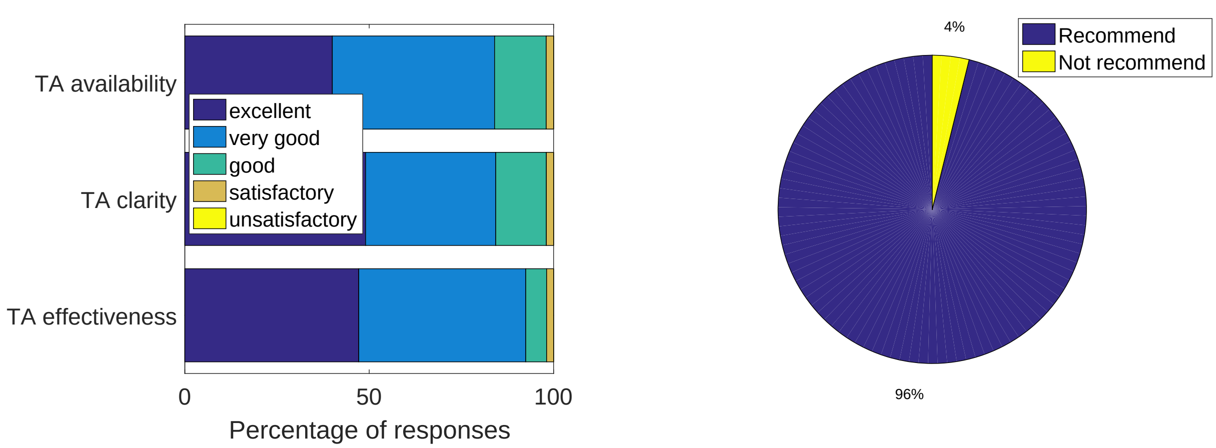


Figure 5.3: APMA 0350 Teaching assistant effectiveness, clarity and availability (left); Recommendation of TA for other courses (right)