

# TEACHING STATEMENT

William Duncan (williamduncan@ku.edu)

## Motivation

Throughout my teaching experiences, I have found encouraging and stimulating the learning process in students to be very rewarding. This has been particularly true in mathematics or concepts that use mathematics. As a tutor to both college and high school students, I have taken great pleasure in advancing the understanding of students who have otherwise often been unable to grasp mathematical ideas to a full extent, and who have often thought they are “just not good at math.” Helping these students change that understanding to one of enjoyment and comprehension has been a wonderful experience. Most recently, this has taken place at Baker University, where I have taught the Intermediate Algebra course, College Algebra and Business Analytics courses at their School of Professional and Graduate Studies, and a variety of Quest (general education) courses, each of which incorporated mathematical components. For my work with remedial mathematics students I was given the Distinguished Educator Award in the Spring of 2019 and have since worked to establish the Baker University Math Center, a tutoring-style approach to supporting quantitative learning across the campus.

As an instructor in economics, I have had similar experiences, particularly in teaching and scaffolding the many mathematical concepts necessary to understand economic phenomena. My first experience with economics education was as a Graduate Teaching Assistant at the University of Kansas. During the Fall semester of 2017 at the University of Kansas (KU), I worked with Professor Tsvetanov in ECON 142 as a lab assistant. This meant that I worked with students in an “Econ Lab”, where a range of students could come for assistance and I sought to explain material in a variety of ways to appeal to different types of comprehension. Since that semester at KU, I have assisted with Energy Economics and taught Intermediate Macroeconomics and Development Economics as an instructor of record. Having taught Intermediate Macroeconomics in three separate terms, I was able to experiment with different pedagogical tools. These ranged from flipped classrooms with worksheet days to the Oxford tutorial style. With each pedagogical method, I was able to tailor it to the students in that class and encourage a successful learning experience for the students. This culminated in the fall semester of 2019 with Development Economics where I brought together a range of approaches to build skills in a statistical programming language and mathematical economic concepts. I have continued these approaches in Principles of Macroeconomics (Honors) at KU this fall using an innovative new textbook through the *CORE* program.

One particular motivation for me has been the opportunity to advise students in undergraduate research projects. While at KU, I have worked to provide many

students research opportunities supervising them for their honors thesis, supervising them for the Economic research course offered through the department, and supervising them on independent research projects. These one-on-one mentoring experiences have been phenomenal and I have felt the joy of watching many of them graduate and begin amazing opportunities beyond their baccalaureate degree. It has been particularly rewarding when the students I have mentored have asked me for letters of recommendation to law school, business programs, economics PhD programs, and even one student who went on for a mathematics PhD. Some of these students have written letters of recommendation for me as well and those are included in my teaching portfolio. As I continue on my academic journey, I know that supervising research projects and mentoring students beyond the classroom is a goal I will carry with me and one that will motivate me to be the best professor I can be.

## **Teaching Methods**

As a tutor and instructor, I have discovered the importance of teaching with an understanding of different learning styles. Each student engages with the material in a unique way, and thus the class periods should be organized to accommodate that diversity. For instance, in my MESP Calculus workshops, each class period would begin with a short lecture over the material of the day. This would be followed by group work on problems that had been prepared in advance. I became a facilitator helping them to engage with the problems in the most useful way for their learning preference. Often this would be self-directed and I would ask questions to the group so they would become self-sufficient in discovering a path to the answer. The end of the period would often consist of time for questions on homework problems the entire class had found particularly challenging.

In addition to accommodating different learning styles, I believe that certain concepts are better suited to particular types of delivery modes. For instance, in Principles of Macroeconomics this semester, I have been honing my narrative style delivery method, encapsulating key equations and economic theory in stories about economics. We begin each class period with students sharing the pieces of the textbook reading that most caught their attention. Each theme that they mention is put on the white board and I then use those themes to piece the narrative together to make sense of the main ideas discussed that week. This approach does not lend itself, however, as well to the delivery of Calculus concepts. When I teach Calculus, the approach is driven more by problem-solving and applications. Students will think about mathematics exercises during class and note the key steps involved in the setup and solution of the exercise. This helps them understand how to apply the Calculus concept in any number of different settings so that the students do not feel confused when the same concept appears in a question with a different context.

While the learning styles and delivery methods in the classroom are critically important, I also emphasize the importance of teaching outside of the classroom. In this respect, my experience as a tutor serves well. Office hours are an important time to fill gaps in students' understanding of concepts. It provides another reference point for students to remember concepts as well as to solidify understanding of concepts. Because the office hour is usually targeted at individuals rather than groups, this allows me as an instructor to fully explore their knowledge of the topic and point out homework problems that would be useful for them to work. As a complement to office hours, I frequently devise assignments that require one-on-one or small group conferences with students. This provides a very structured approach to learning skills like writing research papers and developing group presentations. One of the benefits of conferencing with students is that it helps to scaffold assignments and engages them with their feedback.

### **Assessment of Effectiveness**

To fully understand the progress students make in my classes, it is necessary to measure the effectiveness of my teaching. As a tutor this generally happens by seeing the marks students receive on their homework assignments and common assessments such as exams in the course. As an instructor, the assessments have been varied. They have included worksheets, homework assignments, exams and participation. I believe that effectiveness is measured through mastery, and assessment is an approximation of a student's mastery over concepts. This has been particularly true in the use of ALEKS, an online mastery-based program used for Intermediate Algebra at Baker University. For students who struggle with mathematics concepts a mastery-based approach can be particularly beneficial as it scaffolds for them and allows them to 'build' knowledge until they are capable of moving forward.

One area where I would like to expand my ability to assess effectiveness is through the use of online resources. The use of software which students find intuitive can be helpful to assess them as they learn (formatively) and periodically (summatively) to benchmark their progress. I explored this with Principles of Microeconomics at Baker University using a program called TopHat. This provides students with an online textbook available through a browser and through an app. The students answer questions as they read which are scored and entered into a gradebook. For class periods, I am able to develop slide decks which include questions synchronized with their readings and students answer those questions as the lecture progresses, the results of which weight their attendance in the gradebook. At the end of each week they have a summative homework assignment which compiles the concepts into a few questions and once each month they take an exam consisting of 3 chapters. This may not be suitable for all classes, but there are many features which have appealed to the students including the instantaneous feedback

and the constant formative assessment as they learn. Additionally, I am exploring additional online resources in Principles of Macroeconomics (Honors) at KU this semester. Here, we pair theoretical concepts with applications using data: this integrates *The Economy* textbook with the *Doing Economics* textbook from the CORE project. At the end of each week the students and I work through an empirical project together that clarifies the concepts discussed earlier in the week. We use the R statistical software package to generate visualizations of the data and explore theoretical predictions about how the data should behave.

### **Technology in the Classroom**

As part of an effort to thoughtfully incorporate specific technologies in the classroom which enhance learning, I have accumulated several which have become regulars in my syllabi. Some of these are listed below with descriptions of how they work and how I use them.

#### *Kahoot*

This is an online quiz program which students really enjoy. I have encouraged the use of Kahoot in student presentations as a way to engage with audiences. This is something I used at Baker University for many courses and students would use it in their group presentations. It has also been a tool I employ to review for exams when there are multiple choice questions that will be included. The students seem to enjoy this option for review as they get points for correct answers and for the timeliness of their answers and are graded against their peers. As a sidenote, this was a technology highlighted by the KU Center for Teaching Excellence as a method to engage undergraduate students in the classroom.

#### *CATME*

This software has proven very useful to me when a course requires group assignments. At Baker University, the general education curriculum requires that students do a certain number of group assignments to facilitate learning how to cooperate on tasks and group communication. Students often struggle with this kind of work, so using an algorithm helps them to feel that the group assignments are fair. CATME allows students to answer certain questions which are then treated as indicators in an algorithm to match students either with similar responses or with dissimilar responses. The instructor can decide for each question whether the algorithm should cluster students who respond similarly (for instance time available to meet) or disparately (for instance - type of task that feels most comfortable). Once the instructor has identified the number of groups and the number of students per group, this algorithm then optimizes the student assignments. The motivation of using this tool is to create groups which work more seamlessly based on research in pedagogy rather than a haphazard assignment such as numbering off students or letting them choose for themselves.

### *R and STATA Statistical Programming Software*

Because the ability to analyze data has become so appealing to employers in a variety of different industries, I try to include some level of student use of R or STATA in my courses. This has ranged from courses such as Business Analytics to Development Economics to Risk Analysis. As such, I have managed to develop a variety of interesting datasets and assignments which convey some accessible ideas about data management or data analysis and the students are exposed to programming in a statistical software package.

In an economics course like Development Economics, textbooks often reference a variety of datasets from institutions like the World Bank and the World Health Organization. Using that data in R or STATA to then generate some of the same graphs that are included in the textbook and other graphs that are not included helps the students understand at a deeper level the content that is being discussed. I have often provided the code to the students so they have a baseline with which to work and then may ask them to branch out slightly to perform commands in R or STATA that are not included in the code that I provide. This helps them get over the initial syntactic hurdle and also find the numerous resources available online to help them learn the programming language in more detail.

In a business analytics or data science course, I introduce R as part of the data science life cycle. Many of the datasets that we use are contrived, but others are real data from company sales, Kaggle competitions, or government sources. The students learn a range of analysis techniques from descriptive and inferential statistics to mining algorithms such as Support Vector Machines or K-Nearest Neighbors.

### **In Summary**

In this teaching statement, I hope to have conveyed some parameters regarding how I think students should be taught, why I hold those beliefs, and how I endeavor to do that. As an undergraduate, I read a quote in Dr. Erin Joyce's Intermediate French class written by Antoine De Saint-Exupery in *Le Petit Prince* which has come to summarize a guiding principle of this teaching statement: *"If you want to build a ship, don't drum up people to collect wood and don't assign them tasks and work, but rather teach them to long for the endless immensity of the sea."* As I continue to share my passion for economics and mathematics I hope to instill a longing in students to know and appreciate these concepts as beautiful and useful in their lives.