Teaching Statement for Joseph Spivey

My teaching has evolved tremendously since coming to Wofford. I typically spend a lot of time thinking about what went well in a course and what could be improved, and try very hard to innovate constantly. Innovation keeps the material fresh for me and fresh for the students. Learning how to be an effective teacher is a lifelong process that requires a lot of time and energy—but anything that is worth doing is worth doing well.

I find it difficult to give a comprehensive picture of my teaching, especially since my understanding of teaching is constantly evolving. Instead, I’d like to offer a snapshot of my teaching at this moment in time. Here is a partial list of my most important teaching considerations that I’d like to discuss in more detail:

- **Use teaching techniques appropriate to the student.**
- **Provide clear guidelines and feedback.**
- **Students learn best by DOING.**
- **Technology can be a powerful teaching tool.**
- **Students are more likely to have fun learning if I have fun teaching.**
- **Often, the most effective instruction is one-on-one.**

**Use teaching techniques appropriate to the student**

It is important to meet students at their level. Techniques that are appropriate for students taking a sophomore-level mathematics class for majors are certainly **not** appropriate for students taking “Appreciation of Mathematics”. I think a lot about the needs of the students when I design policies for a course.

For instance, many students in “Appreciation of Mathematics” have negative feelings about mathematics because of past experiences. Anxiety is often high. For this reason, I don’t give tests in this class. Instead, assessment comes in three forms: short quizzes, biweekly problem sets, and presentations on historically important mathematics. Students work together in groups for the problem sets. Clear communication of solutions is emphasized over simply getting the right answers. What they learn about teamwork will likely stay with them far longer than the mathematics. I use peer assessment for these problem sets to make sure that every student is accountable. I tried to align the goals for the students and the means of assessment with desired outcomes of a good liberal arts education: that students be able to communicate clearly, that they work well together on teams, and that they see connections between different subjects (like mathematics and history).

I also keep the needs of students firmly in mind when I design daily lessons. For this class, I often use detailed Powerpoint slides in class, which I post to Moodle after class for students to use in studying. These Powerpoint presentations allow students to pay close attention to the mathematics in class without having to worry
about copying definitions and formulas. They are also very useful for studying for the quizzes.

In addition to group work, we use play dough, Zometools, and other manipulatives in class. Sometimes, there is no substitute for being able to touch and feel the mathematics at work.

On the other hand, the students who take Calculus I have very different needs, so a different approach to teaching and assessment is necessary. Many Calculus students will need to apply the theory of Calculus to different subjects including physics, chemistry, and biology. Traditional testing is a good way to determine if students understand how to apply Calculus to solve problems. In this class, I give three tests, two of which are theoretical and the other of which is computational. I divide the tests this way for several reasons. First of all, this division emphasizes that there is a lot more to Calculus than merely memorizing formulas and doing computations. Also, the division makes it possible for students to have two chances to take the computational test. This encourages students to truly master the process of taking derivatives, a skill necessary for applying Calculus to other subjects. It also reinforces retention of material and discourages the "cram-and-then-dump" method of study that some students seem to prefer.

I give Calculus students a worksheet to fill out for every class period. The worksheets serve as useful study guides and help students to organize their notes. There is lots of blank space in the worksheets for students to take their own notes; this encourages attendance and active participation in class.

**Provide clear guidelines and feedback.**

Trust is an essential component of a healthy learning environment. The teacher must trust that students won’t cheat, and students must trust that the teacher has their best interests at heart. Lost trust can negatively impact teaching and learning.

For this reason, I think it is important to be as transparent as possible. I post all grades to Moodle so that each student knows his or her exact grade at every point in the semester. There are fewer surprises at midterm, and students can check up on me. I encourage students to let me know if I made a mistake. Transparency helps to create trust. Additionally, grades are no longer as mysterious to students since they can see exactly how the grades are calculated.

I also think it is important to establish clear guidelines on every project. Student submissions are much better when clear guidelines are communicated up front. For this reason, I develop detailed rubrics for most main projects in my classes. I provide many written comments as well. I hope that students will learn from the feedback and incorporate suggestions for improvement in subsequent presentations. I also like rubrics because they help me to be more consistent in my grading.
I give my students lots of comments on graded assignments, because feedback is an important part of the learning cycle. I want students to understand that learning doesn’t end once the assignment is turned in. Specific comments on submissions are even more important than the numerical grade because they allow learning to continue.

**Students are more likely to have fun learning if I have fun teaching.**

I love mathematics, and I love teaching mathematics. I strive always to have fun while teaching because I cannot expect students to enjoy the subject if I don’t. Students often write on final evaluations that my passion for mathematics is contagious. I try to let students see the subject of mathematics through the same rose-colored lenses I use. My hope is that students see my passion for mathematics and move from “He must be crazy if he loves mathematics that much” to “If he loves mathematics that much, maybe I can find something about mathematics that interests me”.

I also like to have students play games. One of the articles that we read for the Video Games Interim Project made the point that all games teach. Chess teaches you to think several moves ahead and to get inside the head of your opponent. Basketball teaches you how to shoot a jump shot and how to play on a team. Golf teaches humility, or so I hear.

I realized that games could be a useful way to make learning fun. The trick is to align the goals of a game with specific teaching goals. One of the most successful games I have introduced in class is to help students learn about l’Hospital’s Rule. The basic idea is that I give students several problems to work. The answers to the problems are arranged in Bingo grids. Each group gets a different Bingo grid. The first group that successfully works problems whose answers line up across, down, or diagonally, wins. This game transforms the drudgery of practicing computations into a fun competition.

My favorite aspect of this game is that a group will often get one away from a Bingo. That group will then look at the answer that they are missing and try to find a problem whose solution has the form of the answer they seek. It is a Calculus teacher’s dream to get students to make connections between the form of a problem and the form of an answer, to try to predict the form of an answer at the outset, and to think beyond individual problems and categorize problems into different classes. In playing this game, many students not only look for connections between problem and answer without me asking them to, but they have fun doing so!

Sometimes, classroom games surprise me. A game we played in the Nonverbal Communication Interim Project is one example. I wanted students to see that nonverbal communication pervades every encounter we have with one another. We send and receive nonverbal cues all the time, usually on an unconscious level. To get students to understand this on a deeper level, I designed a game. The game began with a pair of students sitting in chairs at the front of the classroom facing one another. The goal of the game was to have a conversation without using any body
language. The first person who used body language was eliminated, and the next student in line came to take his or her place. The other students in the classroom watched the students at the front for the tiniest twitch of the lips or movement of the head. I have never been in a classroom where the students were focused so intently as one on a single activity. As the students at the front talked, the tension in the classroom built and built, until finally the classroom erupted when one student nodded or tilted his or her head. Usually, the person at the front was totally unaware that he or she had moved. Several students said that the game was much harder than they had thought it would be. This simple activity made my point far better than a lecture could have.

Another game we played in Nonverbal Communication was “To Tell the Truth”, based on a television game show. This game was designed to test our abilities to detect deception signals we had learned about. The class was divided into groups of four. Each of the students in a group told me an interesting story about him- or herself that no one else in class knew about. I selected one of the stories, and had those four students familiarize themselves with it. Then, each student tried to convince the rest of the class that the story was about him or her. Students in the class could ask questions of the panelists, and then had to decide who was telling the truth and who was lying. Body language was carefully scrutinized to try to detect lies. Students were right a small fraction of the time. It turns out that detection of deceit signals is very difficult, which was a good lesson for us to learn!

“Appreciation of Mathematics” also offers chances to have fun while learning. I have introduced mathematical games to get students to think about winning strategies. I have also had students make 3-D models of Platonic solids so that they can see and touch them. We talked about the mathematics of poetry when we discussed the Oulipo movement. I also conducted one class outside so that students could experience the mathematics of soap bubbles for themselves.

**Students learn best by doing.**

The book that has influenced my teaching more than any other I have read is Zull’s *The Art of Changing the Brain*. The premise of the book is that neuroscience offers many insights into the way that people learn, and these insights are valuable for teachers. Zull makes many good points in the book, but the one that resonated the most with me has to do with the Kolb learning cycle. Much research has been done on the following four stages of the Kolb cycle:

1. Concrete experience (doing/having an experience)
2. Reflective observation (reviewing/reflecting on the experience)
3. Abstract conceptualization (concluding/learning from the experience)
4. Active Experimentation (planning/trying out what you have learned)

Let me illustrate with an example. One of the first things that I tried to teach my daughter Kathryn was the concept of the color “blue”. I held up a blue ball and said

---

“blue”. Kathryn then explored the blue ball in the ways that toddlers typically do—she touched it, picked it up, and put it in her mouth. These concrete experiences constitute the first part of the learning cycle. Then, Kathryn had to reflect on the experience and connect “blue” with the ball. This was the second stage of the cycle. I continued to point out “blue” objects: blue shirt, blue toy, blue book, etc. Next, Kathryn had to think about what all the “blue” things had in common. Was it a certain taste, shape, or texture? Were all these objects a certain size, or a certain weight? She was in the third stage of the learning cycle. Finally, Kathryn had to make a guess what “blue” was and then plan out an experiment. She might point to an object we had not talked about and say “blue”. She would look at me to see my reaction. My feedback let her know if she was right, and provided a concrete experience that started a new round of the learning cycle.

Zull argued that neurobiologists have mapped out which area of the brain corresponds with each stage of the learning cycle. Perhaps not surprisingly, these areas occupy four quadrants (roughly) that are next to one another. His conclusion was that the brain is arranged in a way to support this learning cycle (or alternatively, the learning cycle consists of the stages in this order because of the way the brain is arranged). The message is clear—to be most effective in teaching, we must design our lessons and our courses to support this learning cycle.

I seek out innovative ways to engage the senses of my students while in class. I have already pointed out several activities I use in class to give students rich concrete experiences. I also ask students to make connections. I have students work together in class because it forces them to communicate with one another. In order to communicate, students must generalize the concrete experiences that they have and experiment by saying words out loud. Often, students don’t really know what they do or don’t understand until they try to put their thoughts into words. Communicating with others is the true test of understanding. This process encourages students to go through all four stages of the learning cycle.

I also keep the learning cycle firmly in mind when I design Interim projects. I love the Interim term because it provides opportunities for experiential learning. Each one of the Interim projects that I have designed carries a large experiential component. My hope is that the more traditional components of an Interim project (like readings, lecture, and classroom discussion, for example) and the experiential learning components (like inhabiting virtual worlds, performing experiments about nonverbal communication, and playing spy games, for example) mutually support one another. Ideally, what students learn in the classroom should inform the experiences they are having, and vice versa. I take great care to have traditional learning and experiential learning integrated tightly together, as the syllabi illustrate.

I also love the Interim term because it gives me opportunities to experiment with new teaching techniques. I take a lot of risks during Interim, and as a result learn a lot about what works and what does not work. For example, in the Virtual Worlds Interim Project, I designed a mock trial for the class to conduct. The question at the
heart of the trial was whether a Ponzi scheme in a virtual world constituted a Ponzi scheme in real life. The boundary between “real” and “virtual” currency is a very fuzzy one; many economists see no distinction between them. Each student had a role in the trial. Roles included a plaintiff, a defendant, prosecutors, defense attorneys, various expert witnesses, and jurors. My goal in designing the trial was not to sway students’ thinking one way or the other. Rather, I wanted them to think about the different arguments and come to their own conclusions. Students enjoyed taking on roles (one even affected a Russian accent just because he could) and watching the trial unfold. Students were engaged in the process for about three hours of class time! It is sometimes difficult to keep students engaged for even an hour, let alone three. Yet students were happy to be engaged and to think for extended periods of time because they got to participate in the construction of knowledge, rather than being passive recipients of it. They experienced all parts of the learning cycle through this courtroom drama. I’m willing to bet that this was an experience that they will not soon forget. I have never had the opportunity to design a mock trial for the mathematics classes that I teach, and I knew very little about how to construct one. Nevertheless, I took the risk and the activity turned out to be instructive for the students and for me. For instance, I learned that students had trouble piecing the various arguments together. Next time, I will find a way to help the students tie all the threads together.

**Technology can be a powerful teaching tool.**

New technologies offer power new ways to teach mathematics. For instance, the use of graphing calculators in teaching Calculus was very controversial fifteen or twenty years ago, but today it is common to see graphing calculators in the classroom. Graphing calculators can graph complicated functions with ease. This allows us to spend more time understanding the theory of Calculus and less time on mechanics.

Mathematica is another technology that has been very helpful in the classroom. Mathematica is a software program that is helpful for computing and visualizing mathematics. I taught Multivariable Calculus in a computer lab so that students could use Mathematica during class. I have also developed several Mathematica worksheets that are useful for teaching various topics. One worksheet that I authored helps students visualize certain shapes obtained by revolving graphs of functions about axes. As the slider is moved, the graph rotates until the entire figure is shown. Students can also make the shape transparent and rotate the figure to see it from all sides with a click of the mouse. These shapes are explored in Calculus II.

In order to compute their volumes, it is necessary to think of the shapes as circular slices lined up next to one another. A second slider on the worksheet allows students to see what the shape looks like if it is broken into slices.

**Often, the most effective instruction is one-on-one.**

I believe that one of the most important aspects of my job is one-on-one instruction. Wofford prides itself on small classes and plenty of opportunities for students to get to know their professors. I encourage and expect students to come to my office often. I have high expectations of my students in the hopes that students will rise to
meet them. I want to challenge students in lots of ways—but it is important that I support them as well.

My office has a blackboard and a big table, which is perfect for working with groups of students. Often, my office is full of students. One of my top priorities is to meet with students who need help. When I meet with students, I try to model the right ways to think about problems. I ask a lot of questions and praise students when they are successful. I try to get students to learn from their successes and failures. I tailor my instruction to the individual student.

I also take the time to go over tests with students and talk about areas in which they could improve. I help students learn to read textbooks critically and I give advice on how to study mathematics. I also ask about their hobbies and what they did over the weekend. I care about them, and I try to let them know that. I have found that students are far more motivated if they know that I care.