In graduate school I have worked on a spectrum of courses from beginning undergraduate to the advanced graduate level. I've had the opportunity to work in a variety of teaching roles from curriculum development to sole instructor. Through this, I have learned to always bring the following objective with me: Students should not just master course material, but become master thinkers. I think the structure of mathematics courses provide unique opportunities for pursuing this objective.

My approach to teaching is cognitive. Each student comes with cognitive skills and prior experience from which they actively construct knowledge. For me success is understanding and helping to improve those skills.

When the opportunity arises, I like taking time to play the following games with students: Fluxx, Set, and chess. Each develops different mathematical concepts. Fluxx teaches about axioms. Set teaches abstraction. Chess teaches implication. By approaching these concepts from a playful perspective students feel more comfortable and begin developing language for talking about how they learn.

I also take opportunites to stress that there are many beautiful results in both mathematics and theoretical physics. An example in mathematics might come from complex-variable theory, like contour integration and the theory of residues; in classical mechanics it might be the wonders of the ellipsoid of inertia, whose mere existence trivially shows, for example, without calculation, that the moments of inertia about any line through the center of a cube must be equal. I want them to know and learn to enjoy and be on the lookout for these manifestations of the aesthetics of science. Such examples rescue students from looking at theory as a forest of formulas to be learned, but rather a forest with lots of flowers and other marvels. They learn to appreciate the beauty of an elegant proof and altogether realize that there is "style" in developing a theory or even merely solving a problem.

In helping them develop their cognitive skills, I find success in leading by example. When lecturing I deliberately leave holes in my notes such as unfinished proofs or unworked examples. This way students see my thought process and how it pertains to the course materials. In doing so, they are provided with not just how to solve the problem, but they take away an example of how to think about it.

Because of this, the lower level math course I most look forward to teaching is calculus. Calculus is a first step in to a much bigger world that can feel alien, even frightening, to students. That new world brings with it many amazing things though and I think my background in physics provides me an advantage in displaying them.

I also want students to be aware of what goes on inside their heads. During office hours I ask students to write down their question, what they know, and why they think it's true. The goal is for us both to see their thought process. In doing so, we can identify not just what they've missed but why they may have missed it.

In the classroom I keep students constantly engaged. Working at the board, I ask them guided questions about the next steps to help them find their way. I encourage them to ask me questions that arise while they are working through those steps. Through this back and forth we engage in a collective thought process and they end up feeling they have taught themselves.

I get visibly excited when a student shows insight or a burst of intuition. These things indicate to me that their cognitive muscles are being flexed. When this happens, whatever else is going on, I want to stop for a moment and explore it; together we figure out what caused the intuition and what the steps are in between. This excitement is also a positive reinforcement for students which is especially helpful when they think they are on unstable footing.

Finally, I want students to feel comfortable learning from each other and I encourage collaboration. When working together they engage in collective thought: sharing, teaching, and improving the cognitive skills they brought with them. It is their peers with whom they continue developing and this sets them up to support one another.

I have been able to practice this as part of teaching the physical measurements lab. In This class I focus on getting students to ask their own questions. My goal is then for students to learn to use available resources - including their peers - to find answers and ask more questions.

In order for this to work, I have to be a reflective practitioner. I engage with my students to discern what they did and did not find clear about my instruction. After individual lectures, I immediately tweak my notes to better the material in the future. At every point I am continually learning to be a better teacher.

During the summers of 2012 and 2013, I was involved in a project to re-write the mechanics lab from the ground up. Our students had expressed to us that the individual labs felt disjointed from one another. The students now work throughout the semester towards a definite end goal which we show them up front.

I am enthusiastic about this methodology because it develops exactly those things which help students, especially undergraduates, learn to do research. I am most excited for that possibility because I look forward to their becoming peers and successful mathematicians on their own. By taking the long view with the skills of inquiry in mind, they can more successfully develop their own approaches to discovery.

Whether cognizant of it or not, students should always be working to improve their thinking. Self awareness and reflection are skills that will serve them not just in mathematics, but their daily lives. I want to approach my teaching so that I foster growth and development in this way.