

While many advocate for the study of mathematics because of the abundance of its applications in many fields of science, what I love about mathematics is that it expands our horizons, not just in our studies, but also in our lives. I believe our paramount goal is to carry this formidable tool to our future generations through great teachers. A great teacher should not only teach the materials in an organized, clear and a thorough manner, but also needs to leave an imprint on the way students think and view the world around them, and give students the thrill of learning, which I consider one of the most humane of experiences. Obviously, learning is not what happens on the board, but is what happens when students understand how to interact with a concept, through using it correctly, and communicating it to others. Guiding this development, is a great pleasure, and an excellent opportunity for me to revive the joy of first understanding the concepts myself. I hope I can transfer my joy to my students, so even the ones who do not like the subject, can still leave the class with a more positive view on mathematics than when they first came in. I will elaborate on how I involve the students in their own journey through the wonderful art of mathematics.

It is effortful for most of us to change into the mindset needed for abstract thought. At the beginning of the lecture, students may need a few moments to get adjusted to the class environment. I usually start my class by quickly reminding everyone about the main points from the previous lectures, and then go through a couple of problems about the new topic. Before doing each step, I ask students for their ideas on what I should do next. If nobody suggests any answers for the next step, I either ask questions about what they already know, to lead them to the right answer, or do a quick example with a similar method, and see if they can observe the pattern. I encourage participation by writing all the answers and suggestions students give me on the board. If there are too many different answers, I take a poll to see which one they agree with the most, and follow through with that answer. This helps me realize if they have an accurate understanding of the concept, and what their strengths or weaknesses are, or which topic I need to spend more time on.

I think it is not only important to see how to correctly solve a problem, but also to know what not to do. We as humans, tend to repeat what did not have unfavorable consequences for us, and similarly when a student has already learned something incorrectly, they might keep making the same mistake in their own work. I often keep the common errors in what students suggest (for example $(a + b)^2 = a^2 + b^2$) in a box, with clear indicators that those are among the mistakes they should avoid, and have students tell me, or give examples, on why those statements are false. Also, when I introduce a new concept to them, I clearly say and write down how it is different from the previous concepts, which may look similar. For example, when I do a problem with composing functions, I emphasize how composing is different from multiplying through doing a short example, and how order of composing is important. After each new definition, example, or computation, I make sure everybody feels comfortable with what is on the board, and that they always feel welcome to ask questions, or point out to what they did not understand.

Learning new concepts is a difficult task, which I think can only happen through struggling with it through different angles. That is why group work is the most important part of the class. After giving students a short lecture, and going over the main ideas, I give them a worksheet specifically designed for that day's materials. I make sure they work in small groups. On the very first session, after I introduce myself and tell students about the goals, the prerequisites, and the general framework of the course, I give them five to ten minutes to get to know a few of their peers at a personal level. I ensure that they to talk to each other about non-course related materials, and then if the class size allows, I will ask them to introduce the people they just met. In my experience, this, in addition to being a great ice breaker, is an effective way for students to feel more comfortable in the class, and ask questions or give suggestions, if they had any. This also leads to better communications at the level of groups.

Of course, group work does not always go as smooth as one may hope to. While the students are

working in their groups, I walk among them, and observe their work. If there is not enough contact between students in a group, I encourage them to talk to each other and check their work with one another, before they ask me whether they have the right answer or not. If they are communicating well with each other, then I try to peek at their solution without interrupting their group work. In case they do not have the correct solution or the right answer, I usually point out the problem, and ask the group to reevaluate their work on that specific problem together. Despite that, sometimes a group may not be able to come up with a correct answer, or be confused on how they should start solving the problem. In that case, I ask them to explain what they have done so far, or what they think could work. In case they misunderstood the problem, I try to rephrase it in a simpler way, so they can keep working on the problem. If the problem they have is similar to one of the problems on the board, I go over the ideas involved in the problem on the board. I often ask simple examples, that help guide them to the larger concept, and make sure they understand the concepts properly.

Our students always come from different backgrounds, and have different styles of learning. There are usually some students who are struggling with the course materials. I spend more time with these students to understand how their learning process is different from others. I try to come up with a method more suitable for them, and encourage them to attend the office hours, or stay after the class for some more examples. I may even try to break the problems into several steps, so they can keep moving forward. I keep them energized and motivated by sharing my passion for the abstract materials we are working on, and for the exciting process of discovering what we did not know before, which I think can leave a positive impression them. Meanwhile, I emphasize that I mainly care about understanding the concepts, rather than being able to come up with the right answer. On the other side of the spectrum, there are also students who always finish the problems very quickly, and may get bored from the class. First, I ask them to assure that everyone in their group or around them, also has a correct understanding of the concepts. Then I often entice them by telling them about deeper patterns in what they are studying, or coming up with some more challenging problems, which they may face in their future courses, and keep them engaged and excited. In fact, one of my best students who was planning on studying chemistry, kept coming to my office hours for more interesting problems, and she ended up changing her major to mathematics.

I consider grading less as a scale used to see who should pass, and who should not, but more as a method to give feedback to students on what they have learned so far. I always grade their homework or quizzes or exams in a timely manner, and often leave comments on where they have gone wrong, and point out the correct method, if there is a deep conceptual error. Most students may not look into their errors, if they are only given a grade on a sheet, even if the solutions are given to them. I return their graded sheets to them as soon as possible, and remind them that if they do not agree with why their solution is incorrect, and why they lost points, they should talk to me some time after the class, until one of us has convinced the other.

Feedback is essential in stopping us from continuing to make a mistake. That is why I carefully read the feedback students give, and even if I do not agree with their criticism, I try to understand why the students expressed what they had. I try to incorporate methods to resolve the issues my students point out to me, and keep getting better at my job.

I believe in group work, because I consider learning a human experience. Although it is absolutely essential to get the concepts correctly, but more importantly, one should also be able to express their understanding and reasoning behind the concept. In other words, students should not only know the correct solution, but also have the confidence, and the skill needed to persuade others that their solution is correct, and can effectively distinguish the right solution from the wrong one. These are all very well reinforced through group work, by explaining the solutions to

their peers, and checking other solutions that may challenge their own, and deciding which one is correct. Improving such capabilities, cultivates analytic and critical thinking, and extends beyond math courses into the students' future career.