A Teacher and an Administrator in the Time of Corona

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On March 16th, we got the stay-at-home order from the Emperor of California. As President of Chapman University this threw my entire life into a spin: all of a sudden I had the responsibility to convert the university from, well, the usual way we run a university, to a remote operation. Classes and administrative systems went remote, students had to leave their residence halls, and finally parents, students, faculty started to call frantically. On top of that we had to plan for a financial shortfall that ended up being $13.5M just for the spring (and we are now facing a loss of $120M for this incoming academic year). And so, on that fateful day, I sent a message to the entire community (faculty, parents, students, trustees, news organizations, busybodies everywhere) and declared that Chapman was going remote.

Not good. Not good at all. Until a few days before closing down, I had received thousands of emails from students and parents claiming that I was risking innocent lives (*you have blood on your hands* being the kindest of the comments I was reading). As soon as we went remote, those same people who had compared me to Rasputin switched into a different gear and we were now asking to give tuition back (*if I wanted an online education I would have gone to the University of Phoenix* the most common remark). Great! And then the immediate accusation of having waited too long, as well as the dual accusation of having rushed into the decision.

To top it all off, I had my own two classes to deal with. I was teaching an honors class entitled *Three Infinities* in which I was working with my friend and colleague Marco Panza (professor of philosophy in Paris, but currently a Presidential Fellow at Chapman) to show our non-mathematical students how mathematicians deal with the idea of infinity, and to illustrate this process with three main examples: projective

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geometry, calculus, and set theory. I was also teaching another, less philosophical, class on my own, on mathematical methods for the physical sciences: the usual, fairly traditional class, where juniors and seniors are exposed to a wealth of mathematical methods ranging from the Laplace Transform, to the basics of Calculus of Variations.

The infinity class was the easiest one… we just went to zoom, and we managed to continue the conversation with our students. It wasn't as much fun because my friend Marco and I love to fight in our joint classes. I am a mathematician, and he is a philosopher. I know math, he thinks he knows math (he actually does, but I would never acknowledge this in his presence). He knows philosophy, I think I know philosophy. We have been friends for 40 years, and we both have a temper, and being both Italians, we are loud, and we fight on absolutely everything. He is one of those guys that disagree with you even when you agree with them. And the students love that. They love to see me angry at his obstinacy, and to see him angry at my lack of subtlety. Through these completely unscripted battles, students learn several things that I believe are very important. They learn that people can disagree, even harshly, without stopping respecting and loving each other. They learn that mathematics is not foreign to intellectual disputes about its meaning, and that such disputes add richness and texture to our oh-so-beautiful discipline. This conflict, this expression of love through animosity, was difficult to replicate via zoom. And the students were struggling to follow our complicated arguments on the small screen of their computer. I was zooming from my home office, and Marco from his home office… not the same thing as being in the same room. So, we resolved to write a few notes for the class, with the immediate and modest goal of offering an additional support to our students. The outcome… we now have 250 pages of notes, that are becoming a book. And if you happen to read the book, you will immediately see why I am irritated at Marco (whose second chapter is awfully complicated) and why he is irritated at me (since I apparently trivialize important concepts… or so he says).

Fortunately I was alone in my other class, and I had nobody to argue with. I could teach what I wanted, and how I wanted. But I soon realized that teaching Laplace transforms and the Euler-Lagrange equation via zoom was truly a complex challenge. And so, after discussing it with my students, I went to a hybrid format. I decided to set up a small whiteboard in my home (remember, we could not even go to our offices, because the Emperor, I mean the Governor, had forbidden us to go anywhere, in order to supposedly tame the virus). Armed with the whiteboard and my iPhone, I decided I was going to tape short videos for my students, and then use them to give them additional support through this strange period. To add complexity to the situation, I should confess I am a luddite. Without my two young daughters Arianna and Athena, I am completely unable to even use my iPhone correctly, and one of my fondest memories is to look at my beautiful girls smiling at me with an air of desperation when I ask them how to do something with the settings of the damn phone: I absolutely hate this contraption. So the challenge was of course the fact that I had no idea of how to shoot a video with my iPhone, how to post it on Canvas (or whatever is the name of our system), or to use another very mysterious thing that my daughter calls Dropbox. So, I had to solicit the help of Athena, my 12 year old, to

The author with his daughters, Athena (left) and Arianna (right)

edit my videos. The price to pay was $10 per video, plus she imposed her request to have her introduce some of the videos herself. . . what a disaster!

I waddled through this experience though, and I ended up enjoying it quite a bit. I tried to make my videos short (no more than twenty minutes each) and to convey through them my enthusiasm for the topic. I also learned new things. As I was trying to find a good series of examples for the basic ideas of calculus of variations, I bumped into the absolutely beautiful proof that Johann Bernoulli gave in 1696–97 to show that the brachistochrone was the cycloid. As I learned, Bernoulli had offered different proofs of this fact, but the one that I found absolutely stunning was the one in which he uses Fermat's principle that states that the path between two points taken by a beam of light is the one that takes the least time. Bernoulli then imagined that the medium between the two points has variable density, and uses this, together with the law of refraction, to derive, in a few very simple steps, the equation for the brachistochrone. Wow! What a magnificent piece of work. I was so excited about this, that I shared with my friends on campus, and the (somewhat long) video that I made (accessible as an Extra Source Material to this essay) gave the students both the background (Fermat and the law of refraction) as well as the solution to the problem. Not only is the proof incredibly elegant, but it is one of the finest examples of a proof of a mathematical statement achieved through physics, something that has now stimulated me and another friend of mine, to look in a different way to some problems we have been working on for a while (if this concept fascinates you, I would recommend reading Mark Levi's book *The Mathematical Mechanic*).

Despite my initial concerns, this new way of teaching has met with great enthusiasm from my students (if the course evaluations are any proof, I got remarkably high marks for these two courses, with only one student expressing discomfort

at the use of videos), and I have become such a convert that last week, in a marathon session lasting a day and a half, I have already recorded videos for the entirety of my forthcoming class in ordinary differential equations. This time, however, the taping has taken place in our newly renovated high technology classes (here go another few millions...) with much higher quality video and audio. Corona has not been (and continues not to be) a great thing. It has killed people, it has devastated the economy, and it has made our jobs harder and different. But there is, like in all things, a silver lining. Out of corona I now have a new book (which I would have never written otherwise), and a new appreciation for the use of technology. Who knows, maybe next time I need to adjust the brightness on my iPhone I won't even need to call my daughters.