

# Confessions of a Teacher Man

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This strange title reflects my struggle in deciding whether to present outrageous ideas or serious ones. The title comes from a blend of two titles. Frank McCourt wrote an interesting book titled *Teacher Man* on his experience as a high school teacher in the New York public school system. *Confessions of a Dangerous Mind* was a film about game show impresario Chuck Barris' claim that he was a CIA hitman. Although Barris produced a number of successful game shows, I associate him with *The Gong Show* where terrible amateur entertainers performed until they were booted off stage by the sound of a gong.

# Early Academic Landmarks

- Advanced Kindergarten
- Sputnik and Teaching
- Zen of Learning (MIT)
- Explosives to 360 Assembler (Military)

## Advanced Kindergarten:

Like every other American student, my academic career started in kindergarten. But not everyone is the first son of a Chinese family who has the entire hopes of a new generation on his shoulders. I remember my father telling me that I had been selected to be in a special Kindergarten class. I was a happy kid living in Salinas, CA, the “salad bowl” of America and off to a successful start. But I noticed something unusual about the students in this special class: they either didn’t speak English or wet their pants a lot! After two days, I realized that I had flunked regular Kindergarten !!!

## Sputnik and Teaching:

By the sixth grade, my father came to me again and said: “Son, you have been selected for a special class.” I still remembered the last time that I had heard those words. But it turned out that the Salinas school district was assembling the 20 best students in the area to get an accelerated education to meet the Russian challenge which was initiated

by the launching of Sputnik. It seemed that those endless night hours that my father spent reading math books instead of fairy tales to me made me a “math genius” – sort of.

At least I could fake it. I remember how my “special” teacher was always amazed how I could instantly blurt out the average test score right after she finished putting the final

numeric grade on the board. This was my first attempt at parallel processing in which I added the numbers in my head as she wrote them down. And since there were usually

exactly 20 students, it wasn’t much more of an effort to compute the average.

At this time, my brother asked me what I wanted to do when I grew up. I thought a bit and said: “I don’t know, but I can tell you that the last thing I want to do is get up in front of a class and teach.”

## Zen of Learning (MIT):

The three biggest impacts on my life begin with ‘M’: MIT, the Military, and Marriage.

I entered MIT in the mid 60’s. MIT is an intimidating place where everyone seems to be smarter than you. I still get chills thinking about that 12-year old freshman doing a triple integral in the dirt during freshman orientation.

In my Junior year, I took a signals and systems course. But he had this strange teaching style that still seems to run counter to everything I have

learned about teaching techniques. First, he would have his back turned to you about 90% of the time as he wrote furiously on the blackboard. Second, he had this annoying

(and intimidating) habit of suddenly whirling around while asking a question, pointing a finger at you, and then going onto the next student if you did not look like you were going

to provide an answer at that very moment. After two weeks, I was so depressed, I stopped taking notes because you just couldn’t keep up with his writing, and you would

certainly have no hope in answering his question if you were hunkered down writing in your notebook. But a strange thing happened. Within a few weeks, I began to answer a

few of his questions. And by the end of the semester, it seemed as if I could literally know the answer before I knew how to get the answer. What was astounding was that I

finished a 3 hour final exam in 45 minutes and got a 100 !!! Something went on in that course that I still do not fully understand. Is it possible that the key is that it is better to

## Being a Teacher

- Is NOT like being a tennis pro
  - Even Jiri Vanek (#100 ATP) makes about \$90K/year
  - Travels all over the world
  - Gets lots of requests for autographs from girls thinking he is Roger Federer (\$2.4M last year)
  - Probably wants to avoid having to teach other players
- Is like being Ken Wong, racquetball pro
  - Low career earnings: \$5,000
  - Sometimes travels more than 1,500 miles
  - Can never be mistaken to be anyone famous
    - Except: Wayne Wong, 1<sup>st</sup> free style world ski champ (circa 1972)
  - You can enjoy teaching others to become even better than you

What is it like to be a teacher? Some of you may know that I played on the first pro racquetball tour. Being a teacher is kind of like that being a racquetball pro.

NOT a tennis pro:

Being a teacher is not like being a tennis pro. I had no idea who was the 100<sup>th</sup> ranked pro tennis player last night, but Google told me ....

Ken Wong, racquetball pro:

Being a teacher is much more like being a racquetball pro ....

## Let's Get a little Serious

- My first real course evaluation
  - Maintain high but reasonable expectations
  - What counts is 5-10-20 years later
  - "*Forward leaning*" exams are good, but hard to write
- In the classroom
  - Get the logistics right
  - Don't ask students to work on a problem that you or your grader hasn't tried
  - Challenge the strong; Strengthen the not so strong
    - Have compassion
  - Grading is a conversation between you and the student
  - You will be able to assign grades after 3 weeks with a success probability above 0.90
    - But you can still have a +/- impact

"Forward leaning" exam:

Tries to evaluate understanding of the material, not just regurgitate the content. I discovered that a favorite exam paradigm of my EE professors was to have us derive results of

special cases of material that would be covered in the future using what we had just learned. This type of problem is not easy to develop.

Of course, some homework problems had this flavor so that students experienced working on such problems.

## Why Students Fail to Learn

"Most children fail in school ... Except for a handful ... they fail to develop more than a tiny part of their tremendous capacity for learning ... They fail because they are afraid, bored, and confused.

John Holt

How Children Fail, Revised Ed, 1982

"The student should acquire as much experience of independent work as possible. But if he is left alone with his problem without any help or with insufficient help, he may make no progress at all. If the teacher helps too much, nothing is left to the student."

G. Polya

How to Solve It, 1957

Learning is a cooperative effort between you and the student

I got the first quote from a book my wife was reading (she teaches fifth grade). I think the quote is also applicable to college students.

Polya's comment reminds us of how difficult our job is when a classroom is filled with students with diverse backgrounds and preparation.

## The Dilemma

"... the best teaching can be done only when there is a direct individual relationship between a student and a good teacher

- a situation in which the student discusses the ideas, thinks about the things, and talks about the things

... But in our modern times we have so many students to teach that we have to try to find some substitute for the ideal."

Richard Feynman  
Lectures in Physics, June 1963

I'm sure all of you can do a wonderful job of teaching one-on-one; i.e., tutoring. But the difficulty is how do you handle a class of 30 or 40? Feynman didn't have a solution. And

neither do I. So, we are left with trying how to most efficiently doing something that approximates what Feynman says.

## A Remote Lab Learning Environment

- Pre-canned experiments as well as new ones
  - How to structure to max learning rate and flexibility?
- Student model versus Actual model
  - How to discover and correct discrepancies quickly?
- Support group formation
  - How to develop a support network of peers and mentors matched to a student's needs?
- Rules to Principles to Laws from experimental data
  - How to discover fundamental relationships?
- Knowledge amplification through collaboration
  - How to develop new insights through collaboration?

Some of us in the Applied Research Laboratory (ARL) are trying to address learning issues in networking courses through laboratory exercises. Here are some of our early thoughts.

## Technical Reading Favorites

- Stephen King, *On Writing: A Memoir of the Craft*
- G. Polya, *How to Solve It*
- Richard Hamming, *You and Your Research*
  - Transcription by J. F. Kaiser
- Julius Getman, *In the Company of Scholars: The Struggle for the Soul of Higher Education*

You might find it strange that I have listed something written by Stephen King. His book on writing is an interesting and entertaining read. There are books specifically aimed at how

to write well, but I have found that King is able to get at the heart of the matter in an entertaining manner.

I use to fear the end of a semester. That was a time when I would get severely depressed because it seemed that exam grades would be the lowest whenever I thought I had done my

best teaching. For a long time, I thought that I was the only one that had suffered that feeling. I found out from Getman that I was not alone. And there were so many other aspects

of teaching that I shared with Getman even though he was a law professor.

## And Thanks To

- AGES for this great honor
- Mark Franklin for help and advice  
(and long rallies)
- Jon Turner for a really fun work place,  
etc., etc., etc.
- ARL Gang for inspiration
  - Jyoti, John, Fred
  - Grad Students: Charlie Wiseman, Stephen Levine
- Jerry Cox for being a leader

People who get awards do not get them without help. So, I would like to thank those who have recently had the most affect on my life at WUSTL.

Jerry Cox: Here is a person who has had so many accomplishments and awards. What can I say that will add anything to those who have spoken about him before me? So, I will

make this a personal thankyou. "Jerry, I would follow you into battle!"