To all first-year Calculus students: *pleeease* attend the classes!

Dr Aaron Wiegand
We all know the feeling...

First year Calculus cohort

Me: dedicated, unrelenting, handsome.
Aim of this talk

To complain and moan bitterly about lazy, modern day students.
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To complain and moan bitterly about lazy, modern day students.

To provoke discussion about one specific aspect of teaching mathematics / sciences / anything:

Attendance at lectures and tutorials.
What I want to see during semester:
What actually happens:

Later...
What *I* See at the **End** of Semester:

Provide the first derivatives of the following functions.

a) \( y = 7x^2 + 2x - 6 \)

b) \( y = \sqrt{x} = x^{\frac{1}{2}} \)

c) \( y = \frac{1}{x} \)

d) \( y = e^{(2x+1)} \)

e) \( y = \ln(x) \cdot \tan(x) \)

f) \( y = \sin\left[\cos\left(7x^3 + 2\right)\right] \)

Apparently, \( \frac{1}{2} - 1 = \frac{3}{4} \)
What *Management* Sees:

FL = Attrition

This isn't funny Anymore. Send Aaron a summons.
Before we go any further:

Coordinators of first-year Calculus are the unsung heroes / heroines of mathematics departments the world over:

“Whenever the first-year Calculus class requires a new coordinator, there isn’t a mathematician to be found.”

“First year Calculus is considered by many to be the kiss of death for an academic mathematician’s career.”

Now that I have established my credentials....
So, when new students continue to arrive who are under-prepared, have no understanding about what university education aims to achieve, are revelling in their adult “freedom” to do or not to do, have not yet grasped the concept of personal discipline and responsibility, have an inflated impression of their own abilities, have no skills for effective learning, can’t manage their time, are aghast at the idea of reading something more than once, claim to be incapable of learning facts or methods or times-tables, claim they “freeze” in tests and even assignments, won’t work on problems or answer questions or even try at all because they are utterly petrified of getting anything wrong, and when many kick back hard because they know so much better than the academics who teach them, how, year after year, do we have the successes we do?

We have Magical Teaching Tools, firmly supported by Impressive Jargon!
Tools and Jargon of the Trade

- Lectures
- Tutorials
- Textbooks
- Examples
- Problems
- Assignments
- Tests
- Exams
- Summative Assessment
- Formative Assessment
- Curriculum
- Threshold Learning Outcomes
- Scaffolding
- Peer Learning
- Blended learning
- Intervention
- Peer-assisted Drop-in
- Flexible Delivery (not heard that for a while!)
- Blended pedagogies
- Recorded lectures
- Flipped Classrooms
- Engagement
- Independent Learners
- Learning Facilitator
- Student-Centred Learning
- Graduate Attributes
- Self-directed Discovery
- Curriculum Integration
- Multiple Intelligences
- Differentiated Instruction
- Facilitated Metacognitive Functionality
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“Traditional”
= Boring, stuffy, inaccessible
(T-Rex teaches like this)
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= Shiny and new, and
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Things that are, apparently,
not essential for learning.
(OK, that’s being a bit tongue-in-cheek)
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An up-and-coming shiny
new thing that doesn’t yet exist.
2014, Sem 2 … 46% Fail.
Accepting the Challenge:

2015, Semester 1: An All-Out Effort

• Pre-semester phone calls to all students evaluated as being under-prepared or “at-risk”.
• Special revision workshop before week 1
• **Two weeks of revision of prerequisite material (Pre-Calculus type stuff)**
• Lectures (obviously)
• Tutorials
• Discussion boards
• Links to great online-resources
• Complete re-design of all assessment, especially exams.
• Formative assessment with instant feedback (online stuff)
• Weekly assignments (previously known as “homework”)
• Fully-worked solutions to all assignments
• Practice exams, with solutions
• Peer-drop-in support (two hours per week, often more)
• Attendance at multiple tutorials encouraged
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Added value

Spoon-feeding

A huge effort
We did so much! There must be a good result!

Uh-oh!
42% “Attrition”.

I had better prepare for my biannual roasting

Yay!
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1 = "yes" or "attended"; 0 = "no"; blank = never logged in. A student has at least logged in (very minimal effort). 3 = student has had some sort of serious attempt at the weekly problems up to this point.
Some numbers:

- 5, -3, 0.5, π, 2-3i

- Promised attendance at pre-semester workshops = 65, actual = 17.

- Three rounds of “intervention”.

- Total participation in Peer drop-in sessions = 2 students, a few times.

- 10 students (out of 79) did absolutely nothing after week 6.
Nothing really stood out, except...

...attendance.
Yes I did put in extra work at home and extra study but not a whole heap to be honest. I did all exercises from tuts and most of the text book exercises. I also studied with my house mate who happened to be doing the same course.

I did next to no study, did everything last minute, tutorial assignments were regularly started and finished just before my 10am tutorial, and the only reason I went to one lecture is because I received an email saying attendance was taken.
Success Rates vs Attendance

Number of Lectures Attended

-0-1 2-3 4-5 6-7 8-9 10-11 12-13
-100 -80 -60 -40 -20 0 20 40 60 80 100

Number of Tutorials Attended

-0-1 2-3 4-5 6-7 8-9 10-11 12-13
-100 -80 -60 -40 -20 0 20 40 60 80 100

Percentage of Cohort

Not Fail Not Pass

Not Fail Not Pass
Overall

![Overall Score vs. Overall Attendance Graph]

- Overall Score % vs. Overall Attendance %
- Percentage of Cohort
  - HD
  - DN
  - CR
  - PS
  - FL
Perhaps this amazing correlation is just a fluke?
(One that I have observed for many years, but perhaps it’s just me?)

What does the Literature say?
What does the Literature say?

There is much evidence in the literature to suggest a positive correlation between attendance and academic performance...

What does the Literature say?

....attendance is a determinant of academic performance and progressions....

.... The results of this study show a strong, statistically significant correlation between learning event attendance and academic attainment.

What does the Literature say?

The strongest predictor of success of a course was based on the student’s level of attendance.

What does the Literature say?

The data shows a strong correlation between attendance and success rates across freshman, sophomore and junior levels.

So why is attendance so important?

Apart from lectures being a live, interactive show that encourages participation and stimulates thinking...

Learning new mathematics needs **repeated exposure** (and practice).

- **Lecture (exposure 1):** This first lecture provides a complete, ordered, fully-described and illustrated introduction to a topic. “Yeah, I understood most of what you did in the lecture, but the tute at first seemed completely different and I had no idea what was going on.” (actually, tutes correspond exactly to the lecture).

- **Tutorial (exposure 2):** This revisits the general ideas and reinforces the notation and application of the theory. “Cool, once the tutor explained again how it all fits together, I could remember doing it in the lecture.”

- Weekly Homework (exposure 3): “I read back over my lecture notes, tute working and the examples, and I figured out how to do the problems again.”

- **Subsequent Lecture (exposure 4):** Five minute review of previous week’s material. Also maintains big-picture context.

- Study for, and sitting of, module test (exposure 5)

- **Week 13 Lecture and Tutorial (exposures 6 & 7):** Review of whole semester. “Wow, I’d almost forgotten that stuff. Easy enough to pick up again though.”

- Study for final exam (exposure 8)

**Students who physically attend classes get five organised, directed and interactive exposures to the material, that non-attendees miss out on.**
But our students are great independent learners!

No. They aren’t.

OK, 2% of them are.

The other 98%? They really need to attend lectures and tutes to maximise their opportunity to learn.
Current Status

1. If attendance is not linked, in some way, directly to marks, many students perceive that attending face-to-face classes is an unnecessary hassle.* Attend and participate for the sole sake of learning? You must be joking!

2. Low attendance means that academics must employ elaborate schemes to coax students into attending and/or participating in their own learning! Most of our first-year and second-year students are *not* self-motivated and are *not* independent learners!

*University “rules” which state that we aren’t permitted to make classes compulsory (unless there is assessment in the class) reinforce this perception, although I’m not able to find any procedure that actually forbids us from doing so!
Attendance at MTH202 Lectures

NOTE: prior to 2015, attendance was often about 40%

Q: What happened here?
A: Student apathy followed by coaxing.

So, 25% of the cohort (33% of the attendees) are attending lectures not because of the learning experience, but because it may benefit them marks-wise.

It’s great to see how all these “time-poor” students managed to rearrange their busy lives to attend the lectures, once they knew a roll was being taken and a “tangible” reward was being offered.

(because actually learning stuff isn’t reward enough!).
Most recent fail attrition rates.

Note – this is probably not just due to “attendance”!

We have changed several aspects of the course assessment since 2015, but…

...these changes are specifically designed to encourage attendance and participation, as well as the development of good study skills and habits...

A nearby, very large, very prestigious university also has 30% fail in first year Calculus. Now let’s compare OP scores and entry prerequisites... I think we are doing pretty well!
My career-limiting question

Why is the concept of “attendance at traditional lecture” treated with such disdain, to the point where it is now regarded as “OK” if students don’t attend them?

Our observed reality is a positive correlation between physical attendance in classes and overall learning outcomes. This aligns with the relevant peer-reviewed literature.

So why does university management disregard this particular aspect of our teaching arsenal (physical attendance at classes) and not take it extremely seriously?

For example, we are forbidden to make any lectures, tutorials or even lab classes compulsory for their own sake, but perhaps this will work? (Yup... this can of worms needs to be opened!)

We should be exploring and investigating ways to improve attendance!

Instead, universities (not just USC) are dedicating vast amounts of resources, both human and financial, pursuing the new and shiny pedagogies (which is fine), while brushing off the traditional lecture format as being “out-dated” (which is not fine).
Some “official” answers to my question

- The on-campus lecture services only one kind of learning. It is a restrictive and exclusive format.

- Modern students no longer learn by the “traditional” model.

- Most students are “time poor”.

- Students must undertake more paid work to survive.

- Modern students are “digital natives” and learn best via “web technologies”.

(TO BE DISCUSSED AT A LATER DATE)
How can we convince first-year students to physically attend classes?

What I am doing that sort of works:

**Lectures**
- Take an attendance roll (which ultimately is meaningless, except to present data at L&T week).
- Promise some reward for good attendance (but does require a roll to be kept).
- Keep explaining and reinforcing the need for multiple exposure.
- Explain that the details of the material will not be taught in the tutorials.
- My lectures aren’t recorded, nor do I use Powerpoint, but that is another discussion entirely.
- Put on a good show!

**Tutorials**
- Take an attendance roll.
- Mark weekly homework, in every tutorial. This will probably be my L&T topic for 2017...
If anybody has a burning desire to discuss this issue further, either through fiery debate or mutual commiseration, or has similar data and would like to compare, let’s have a coffee!