Using Confidence Tricks to Make People Learn Maths & Stats

Mathematics and Statistics for Social Scientists (MSSS) is a course offered as part of the Foundation Degree in Management (FDM) programme at the School of Management and Organizational Psychology at Birkbeck College, London. MSSS is offered in the first term of the first year of the FDM programme, at the Certificate level (Level “C”). The weekly sessions, consisting of 3 hours, are run as combined lectures and seminars. Since Birkbeck is a higher education institution that caters primarily to part-time students through evening study, the weekly sessions run from 6 to 9 pm.

Apparently Insurmountable Problems

The Birkbeck Foundation Degree in Management attracts between 115 and 120 applications annually. It accounted for some 36% of applications to all Foundation Degree programmes at Birkbeck in recent years. While applicants are particularly attracted with the short amount of time (8 academic terms part-time) to complete the degree, many of the students wonder what employers think about a Foundation Degree as opposed to a conventional Honours degree requiring at least 4 years part time to complete. We suspect many MSSS students struggled with maths at school: since maths is central to several courses on the Foundation Degree, students fear that they are unable to cope. There are some useful books for such people: we recommend ‘Foundation Maths’ by Croft & Davison (Prentice Hall) to MSSS students.

Colleagues advised us recently that students who passed MSSS had problems when studying quantitative courses in later years. The entrance test for the FDM programme has recently been made harder, which should help.

We get the impression that many of our students think maths & statistics is irrelevant to their future careers (perhaps maths seems as useful as memorising the name of every crater on the moon). We found the best way to get them to learn maths is to use ‘confidence tricks’, i.e. trick them into becoming confident.

Trick 1: Tell them if they fail, it’s the lecturer’s fault.

Admission to the FDM programme at Birkbeck requires passing an entrance test involving a maths test. In the last recruitment exercise, only 43% of the total number of applicants obtained unconditional offers of admission. But MSSS students still vary greatly; it’s a real challenge to keep the best students interested, without leaving the slowest behind. In the first week, the lecturer states that students would not have been admitted to the FDM programme without having passed the maths part of the entrance test; so they have what it takes to understand and learn maths, and helping students to learn and understand MSSS is the responsibility of the lecturer. This statement helps to relieve the fear of maths many students seem to have.

Trick 2: Advise them to avoid Maths.

One MSSS student said she didn’t intend to use maths after finishing her degree: her plan was to get a sufficiently senior job that she could hire people to do maths. In future, we will advise other MSSS students to consider this approach – while warning them that they need maths to pass their degree.
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**Trick 3: Do something impossible.**

We often start by asking students to solve a problem like ‘If the price of a good is £8.99, what would the price be without VAT?’. This usually generates an embarrassed silence, when students have absolutely no clue about how to solve it. After a brief delay, the lecturer invites them to solve the problem by working in groups of two or three. After ten minutes or so, someone figures out the formula $\text{Y} = \text{X}(1 + .175)$, and the lecturer explains it to other students. This will only work with a task that sounds impossible, but is actually easy when you know how. This approach to teaching is sometimes called the “aha” method; it may not work if you have a huge number of students in the lecture theatre – the room can get noisy while students talk to each other.

**Trick 4: Use computers.**

In the first year MSSS was taught, the best thing about it was the two hands-on Excel sessions in a computer room which integrated maths with computers. These sessions had been discontinued since Excel forms part of another course on ‘IT in Practice’. Thus, nowadays the lecturer demonstrates the specific uses of Excel for maths in some weeks.

**Trick 5: Avoid interesting Maths.**

On no account mention matrices, calculus, or any other types of maths you find remotely interesting (if you like it, they won’t understand it). We try to make boring maths seem useful – if they find it useful, then they will pay attention.

**Trick 6: Tell students to stop listening.**

The lecturer of MSSS has to walk a tightrope: not too hard that it puts students off, but not so easy that students get bored. The lecturer sometimes pauses in a lecture, and invites students in the room to stop listening – explaining that the next few topics are purely to further inform the few people in the room keen on maths, and that it won’t be in the exam. After a few minutes, the lecture reverts to material for all students (by which time those students that find maths challenging will have had a rest).

**Trick 7: Have a break.**

The coffee break is the best part of the evening. We tell them they have 15 minutes to get coffee, but they return late – so the break usually takes about 20 minutes. They seem much more awake for half an hour after the break. At the same time, it offers a further opportunity for the keen student to ask questions directly to the lecturer in private.

**Trick 8: Get them to teach each other outside lectures.**

Part-time evening students seem less likely than full-time students to get to know each other, so we encourage them to exchange e-mail addresses and phone numbers with each other, and form a study group consisting of a few students (in a café, or empty lecture room). Some close friendships do form between students in this way.

**Trick 9: Use two different methods at once.**

Some MSSS students find simultaneous equations very difficult (yes, really). We use two methods to solve simultaneous equations: by algebra, and using a graph. Students who struggle with algebra often can’t understand XY graphs either, but some students seem to like using both methods.

‘Simultaneous equations’ is one type of maths which makes students fall asleep. So we told them a business must fit as many desks and photocopiers as possible into an office of 386 square metres, where a desk takes up 3 square metres and a photocopier 2, and that there must be one photocopier for every 9 desks, plus a spare photocopier. There seems some point to this question, so they wake up for a while. This is another example where dividing them into small groups for a few minutes helps.

**Trick 10: Don’t tell them much.**

Some lecturers go to considerable trouble to prepare impressive-looking OHPs, Powerpoint slides, etc; sadly, this seems to make things worse because some lecturers (not just at Birkbeck) display a complicated slide all at once. If you must use technology, we think you should set up your PowerPoint slides so each bullet point is introduced one line at a time. Or if you use OHPs, you could use a sheet of paper to mask most of the OHP, and reveal one line of the OHP at a time. We prefer to use a whiteboard, with lots of different colours of pens.

**Trick 11: Make extra work for students and lecturer - use 2 kinds of assessment.**

Some students seem to think that sitting in a lecture room for 3 hours per week is sufficient to pass. We want them to correct this error before it’s too late. So midway through MSSS, we require students to carry out a coursework exercise, which represents 25% of the mark for MSSS (the remaining 75% is an exam at the end of...
the year). We found a bonus: a way to make maths seem useful. We give them data for a few years, and ask them to make a forecast for 2008, in two ways:

(i) drawing a graph, and fitting a line they think best fits the data – then using this line to forecast for 2008; and
(ii) using data for 2000 and 2004 to calculate average growth (or decline) per year, and hence predict the 2008 value if this trend continues.

We think students appreciate this exercise: their maths ability is sufficient to make a forecast, and it seems useful. To reduce the risk of plagiarism, we give data on dozens of countries, and require each of them to choose three countries to do their coursework on.

**Trick 12: Use pointless jargon.**

Students seem to gain confidence if we use phrases like ‘mathematical modelling’ to describe method (ii) above—but we only do so after students seem to understand the idea. Another trick is to write the equation $X = \frac{\Sigma x}{n}$ and ask if they’d be impressed if a colleague could understand this. When they find it’s just the “average” formula they learnt at school, they seem less afraid of maths.

**Trick 13: Make sure students can’t get full marks.**

In a maths-based course, it may be possible to score 100%; but at Birkbeck (like most English universities), students almost never get a mark over 75% for essay-based courses. We aim to make MSSS comparable to other courses. One way would be to make MSSS so hard that the best student would get about 75%, but this means that almost all students would fail MSSS. We solve this by writing an exam with some easy questions, some moderate, and some almost impossible, and then require students to attempt all questions. We told students recently that if Albert Einstein were to take the MSSS exam, he wouldn’t score much more than 80%.

The hardest parts of the coursework was: ‘Discuss when a forecast based on mathematical modelling is better than a forecast based on a researcher fitting what he or she thinks is the best line to fit recent data’.

**Trick 14: Ask yourself: Why are you wasting your time with Maths?**

We found ourselves wondering why on earth a manager would want to understand logarithms. The best answer we can think of is a ‘log scale’ on a graph, which can show small and big values clearly on the same graph. The lecturer draws a XY graph on the whiteboard with a vertical scale marked 10, 100, 1000, etc; and asks students where a number like 438 would be on this scale. The lecturer then explains the Log key on a calculator, and gets students to verify that Log(10) = 1 etc. After that, it doesn’t take students long to realise they can use the calculator to find Log(438), and place this on a linear scale {1, 2, 3... to represent 10, 100, 1000...}. Another type of maths we try to make relevant to them is numbers raised to a power, by using the ‘compound interest’ formula $F_n = F_o(1+ i)^n$. But we struggle to explain why $2.71828$ is called “$e$” – so why should we teach $e$ to them?

**Trick 15: Help them to daydream in lectures.**

It’s unrealistic to expect students to concentrate for 3 hours especially after they’ve been at work 8 hours, so allow students to daydream a bit, and miss some of the lecture. We give a one-page sheet each week: lecture notes on one side, and ‘self test questions’ on the other. In the following week, we give an answer sheet, and a few of the self-test questions are discussed in class (although most students look bored, since they already have the answers). On no account should you allow them to bully you into obtaining the handout at the start of the lecture, or they’ll be reading the handout instead of listening to you. However, be aware that some students may stop attending because they can get a friend to collect the handout.

**Conclusion**

Over the last three academic years, the average withdrawal rate of Year 1 FDM students was 12.9%, but this figure was probably comparable to other Year 1 courses at Birkbeck. We think many students who drop out of the FDM programme do so not because they cannot cope with MSSS, but because they experience difficulties in combining work and personal responsibilities with their academic commitments. We think MSSS seems to work.

Despite the light-hearted tone of this article, you may wish to consider these ideas seriously. At the end of the day, they may combine with other useful methods to help students learn maths. We welcome your comments.