

While you are waiting for the Flipped Classroom talk...

While you wait you may like to visit www.Socrative.com to take a very short quiz.

Select [Student Login](#) (on a phone you may need to use the 'hamburger', i.e., the three bars in the corner)

For [Room Name](#) enter [KHOUSTON](#) and then select [Join Room](#).

Enter your name (doesn't have to be full name).

Select the [multiple choice answer](#) that best describes your experience and [submit](#) your answer.

Relax.

Flipped Classrooms

Kevin Houston
University of Leeds
K.Houston@leeds.ac.uk

www.kevinhouston.net

Technology and teaching

- MOOCs
- Khan Academy
- Sugata Mitra's SOLE
- Dan Meyer

All use technology so have overlaps.

Flipped Classroom Basics

- Students work through material before lecture.
- Lecture is used to work through common mistakes, misunderstandings, problems and so on.

Eric Mazur's Peer Instruction

One of the most successful examples is Peer Instruction by physicist Eric Mazur from Harvard

- Students read material before lectures.
- Simple problems attempted online.
- Information from problems used to identify focus of lecture.
- Students paired so that they discuss and resolve problems.

Mathematics at the University of Leeds

- 186 intake on BSc/MMath Mathematics.
- Standard offer AAA.
- About 60% have A level FM.
- In 2015/16, we parent 898 UG students.
- In sem 2 of 2015/16 we had a total of 1296 students on our modules.

Number Systems

Number Systems module

- Semester 1 Level 1 – because students don't know any better
- 15 out of 120 credits.
- BSc/MMath students.
- 196 enrolled in 14/15 and 186 in 15/16.
- All lectures recorded and uploaded for later viewing.

Module summary

This module exposes students to the basic objects of mathematics such as sets, number systems, and functions. Basic properties of these objects are explored using mathematical language. Students will develop proof writing skills, and will be introduced to the mathematical word processing tool LaTeX.

Objectives

On completion of this module, students should:

- be able to state and prove elementary properties of integers, rational, real, complex numbers, and general functions;
- have acquired skills such as:
 - constructing, writing (using LaTeX) and communicating proofs using different methods, including mathematical induction;
 - presenting mathematical ideas using precise language in written and verbal form;
 - manipulating and exploring basic mathematical objects confidently.

Syllabus

- Sets
- Functions
- Integers, rational and real numbers
- Proof by induction
- Complex numbers
- Congruences and modular arithmetic, RSA codes

Standard delivery in previous years

- Three one-hour lectures per week for 11 weeks (one week of which is revision)
- Students are in groups of 10-13 for weekly 1 hour tutorials.
- Homework set each week (one question to be done in LaTeX).
- Tutor (poss PG) marks and returns.
- Peer Assisted Learning (PAL) sessions available.
- Presentation component. (Tutorial group, pairs, 10 min talk on maths topic, not necessarily from this module.)

Changes

- Two lecturers: Me and Dr Margit Messmer. Switched at half way and I returned for last week for complex numbers.
- Two one-hour lectures. Monday and Friday.
- Material provided before Friday's lecture:
 - Written notes.
 - Videos: My videos, Numberphile and others, including Big Bang Theory.
- Assessment via Dewis. Formative in intent - Get mark if get more than 50% of that week's assessment correct. Completed before Friday lecture.
- Lecturers go over some material, proofs, tasks, and use Socratic.
- Exam (80%), Homework (10%), Dewis Prep (5%), Presentation (5%). (Students told Exam 80% CW 20% just in case.)

Challenges/Problems

- Timing: My notes needed a lot of thought and revision to fit the format.
- Dewis much more work than thought so my questions released close to deadline.
- I didn't flip enough. Tendency to lecture. I occasionally dropped Socratic and some tasks. Margit: Novelty wore off.
- Students would do Dewis tests until achieved 50% or more and then stopped.
- 'Why do I get 5 hours for something I understand but only 2 for this hard stuff?'
- The Facebook group.

Results/Student response

Similar questionnaires distributed at end of 14/15 and 15/16.

- 14/15 response rate: 53%.
- 15/16 response rate: 73%.

Socrative

The Socrative question during the lectures (tick which apply)

Multiple answers	% of responses
helped me greatly with being engaged	21%
helped me a bit being engaged	43%
were useful	39%
were unengaging	11%
were a waste of time	7%

Other: No smart phone, Fun (x2)

Dewis

The online (DEWIS) pre-lecture preparation questions

Multiple answers	% of responses
supported my learning greatly	13 %
supported my learning a bit	42%
were useful	39%
did not help my learning	16%
were a waste of time	10%

Other comments: Forgot to do them/hard to remember to do, x2

Were too difficult

Could not find answers on pre-lecture reading

Helpful when going through after in lectures, x2

Make longer, more frequent and give optional ones

Answers would be useful

Rely too much on independent work

I find writing a mathematical proof... (check all that apply)

	14/15 in %	15/16 in %
Impossible	3	6
Very hard	16	26
Hard	30	30
Challenging	64	60
Doable	23	25
Easy	2	4
Very Easy	1	0.75
Rewarding	41	28
Enjoyable	17	13
Okay	23	16
Pointless	8	5
A waste of time	7	7

Average hours per week working through lecture notes to prepare for the lecture (not including time to complete the online questions, to prepare for the tutorial or do the homework).

124 responses.

Hours spent	% of responses
0	12%
(0,1)	21%
[1,2)	35%
[2,3)	15%
[3,6)	14%
≥ 6	3%

Mean is 1.47 hours.

Mode is 1 hour.

Exam Results

- Slightly harder exam.
- Results comparable to previous year.
- Margit: Students will not learn proof writing in one semester. What pleased me the most, that most of them seem to grasp the concept of injective and surjective, being able to apply it to different functions, not just \mathbb{R} to \mathbb{R} (although most of them were still not able to describe/define these properties in coherent mathematical language).

Future

- Use more video podcasts on same material. (Wacom Intuos Tablet and Screenflow.)
- Make notes more interactive.
- Make online tasks a learning tool. Issue of personalised feedback - time consuming.
- Overall challenge: Open students' minds to maths as concepts, rather than tools for problem solving and scoring marks in assessments.

Conclusion

Conclusions:

- Avoided disasters!
- Student engagement was very good.
- Student attainment was comparable with last year on a slightly harder exam.
- Saved an hour of contact time.
- Improvements planned for next year.
- Margit: 'Also I found it much more enjoyable to teach in this format – more surprises in the lecture theatre; Socrative gave me an opportunity to 'breathe' (reflect, adjust pace, etc.)'.

And finally...

Thank you for listening.

THE END