FLIPPED TEACHING AS A METHOD FOR ENGAGING LARGE GROUPS

DR SAM MARSH AND DR NICK GURSKI

Abstract. In a large-scale trial at the University of Sheffield ($n = 236$), we implemented a flipped approach to teaching mathematics to first-year engineers. Lectures were discontinued and replaced with an integrated format of specially filmed short videos, online quizzes and twice as much small-group learning. We found strong evidence that engagement and exam performance were boosted by the new method by comparing with students on an identical syllabus taking the same exam but taught traditionally.

1. Introduction

1.1. **Background.** The School of Mathematics and Statistics provides mathematics teaching for undergraduate students in the Faculty of Engineering. Predominantly, these modules have been taught in a traditional format of two large-group lectures (200 students or more) and one smaller-group tutorial class per week. Attendance records are kept for tutorials but not lectures. We find that attendance usually starts high, but drops off as time progresses (see figure 1).

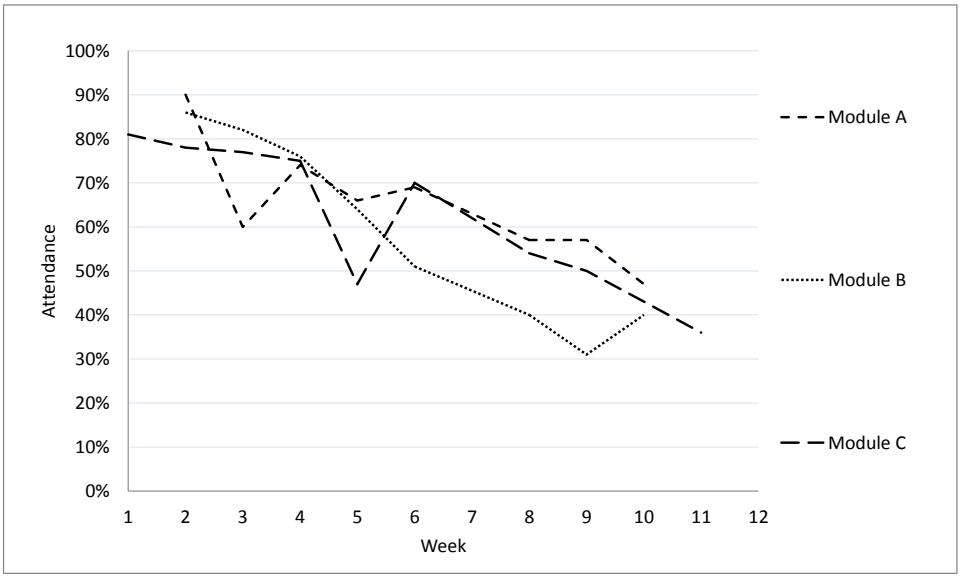

Figure 1. Problem class attendance on three traditionally taught engineering mathematics modules, Semester 1 2013–14

A working group was established to look into the effectiveness of these modules, with a particular focus on whether a flipped approach, based around videos, online tests and small-group classes, could provide a more engaging course for students.

The working group established a key proposal: that large-group lectures would be discontinued, and their content split into theory (to be included in the videos) and examples (to be done in classes). Further, the amount of contact time allocated to small-group learning would double. This approach was to be piloted on a first-year module of 236 students, with two other modules covering an identical syllabus but taught traditionally (totalling 298 students) used as a comparison.

1.2. **Literature.** I suggest we put 2–3 paragraphs about flipped learning here, no more, not too dense for this one.

2. Course structures

2.1. **Change in format.** The difference in structure of our new flipped approach as compared with our traditional course format is summarised in Figure 2. Both formats describe year-long, 20-credit module for first year engineers from different departments but studying the same syllabus. Note that timetabled university sessions are 50-minutes in duration, and these are the units used for counting lectures and problem classes.

	Traditional	Flipped
Lectures per week	2	0
Problem classes per week	1	2
Problem class format	Exercise booklet, reactive teaching	Worksheets, proactive teaching
Continuous assessment	End of semester homework	Online tests
Additional resources	Typed notes, office hour	Video lectures, typed notes, additional exercise booklet, discussion board, office hour

The main differences in approach are that

- three short (10–15 minute) video lectures replace each face-to-face lecture;
- quick online tests follow each video;
- problem classes are more structured and doubled in frequency.

2.2. **Video lectures.**

2.3. **Problem classes.** Old: Each student is assigned to a tutorial group with a ratio of about 20-30 students per staff member or postgraduate assistant; on some courses, tutorials have 40 students with one staff member and one assistant, while others have 80 students with one staff member and three assistants. The tutorial classes generally consist of students working on set problems, asking for assistance as necessary but little full-class teaching.

3. Methodology

Here we outline the nature of the pilot and the data which would form our assessment of effectiveness.

4. Analysis

Here we present our findings.

5. Conclusions

Here we sum up.

6. References

References

[KWSC] C. Karr, B. Weck, D. Sunal, and T. Cook, *Analysis of the Effectiveness of Online Learning in a Graduate Engineering Math Course*, Journal of Interactive Online Learning, **1** (3), 2003.

[JT] M. Jiang and E. Ting, *A study of factors influencing students' perceived learning in a web-based course environment*, Journal of Educational Telecommunications, **6** (4), 2000, 317–338.

[RA] E. Rowe and J. Asbell-Clarke, *Learning Science Online: What Matters for Science Teachers?*, Journal of Interactive Online Learning, **7** (2), 2008.

[GA] D. R. Garrison and T. Anderson, *E-learning in the 21st century: A framework for research and practice*, New York: Routledge Falmer, 2003.

[NK] D. Nguyen and G. Kulm, *Using Web-based Practice to Enhance Mathematics Learning and Achievement*, Journal of Interactive Online Learning, **3** (3), 2005.

[GS] K. Golden and C. Stripp, *Blending on-line and traditional classroom-based teaching*, available at

`http://www.mei.org.uk/files/pdf/LOUGHBOROUGH_PAPER_D3CS.pdf.`

[W] J. Williams, *The place of the closed book, invigilated final examination in a knowledge economy*, Educational Media International **43**, Number 2, June 2006, 107–119.