PTAS Project Report (for REGULAR PROJECT GRANTS)

Project Title: Classroom practices and lecture recording

Project type

A Research Project (research focus on particular dimension of teaching, learning, assessment)

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What did you do?

The two main aims of this project were to:

1. develop an approach to characterising classroom practices, that could be applied reliably across lectures from our disciplines, and
2. investigate the teaching practices in use in a range of different courses at the University of Edinburgh, and how this interacts with students' use of lecture recordings.

Funding from PTAS enabled us to hire research assistants to work on this project. In the summer of 2019, we employed three research assistants: Steph Smith (a researcher in R(D)SVS), Ross Anderson (an undergraduate student in the School of Physics and Astronomy) and Thomas Gant (an undergraduate student in the School of Mathematics).

We explored existing approaches to characterising classroom practices, including FILL (Wood et al., 2016) and PORTAAL (Eddy et al., 2015), by applying these to a selection of lecture recordings from different disciplines. Informed by this, we developed a refined observation protocol, FILL+, which is used to categorise the type of activity that is taking place second-by-second during a lecture. A summary of the codes used to classify activities in FILL+ is given in Table 1, and full details can be found in the training manual that we produced (Smith et al., 2020).

Interactivity	Code	Description
Non-interactive	AD	Admin
	LT	Lecturer talk
Vicarious interactive	LQ	Lecturer question
	SR	Student response
	SQ	Student question
	LR	Lecturer response
Interactive	CQ	Class question
	ST	Student thinking
	SD	Student discussion
	FB	Feedback

Table 1: Codes used in FILL+, grouped by level of interactivity.

Discipline	Course/lecturer combinations	Number of lectures
Biology	2	4
Chemistry	2	12
Mathematics	21	108
Physics	9	60
Vet Science	9	50
	43	**234**

Table 2: Summary of the lectures analysed in the first phase of the project.

We applied the new FILL+ observation protocol to a sample of 234 lectures across a range of STEM disciplines (see Table 2), using recordings from the Media Hopper Replay system. An interim report on this work was written up by two of the RAs for Teaching Matters (Anderson & Gant, 2019) and our final results have just been accepted for publication (Kinnear et al., in press).

In the summer of 2020, we employed three further research assistants to carry out additional data collection. This used remaining funds from PTAS (including some which could not be spent on conference dissemination activity due to the Covid-19 pandemic), as well as additional funding provided by the School of Mathematics. The three research assistants – Gemma Hood, Eloise Lardet, and Colette Sheard – were all undergraduate students in the School of Mathematics.

In this second phase of work, the RAs analysed a further 38 lectures using FILL+. They also learned how to apply the COPUS protocol (Smith et al., 2013), and used this to re-analyse 64 lectures from our combined sample. Furthermore, they carried out an in-depth analysis of lecturers' use of questions in the mathematics lectures in the sample, building on existing work which had developed a way to categorise the types of questions (Paoletti et al., 2018). Analysis of these results is still ongoing (e.g. Kinnear et al. (in preparation)).

What did you find out?

Our main findings, reported in Kinnear et al. (in press), were:

1. The FILL+ protocol can be applied reliably after minimal training. This can be done using recordings of lectures, and across a range of disciplines.
2. There is a diversity of practice in the lectures we sampled at the University of Edinburgh, as can be seen in the summary of the time spent on each type of activity in Figure 1.

While we had initially hoped to investigate how the nature of classroom practice might interact with students' use of lecture recordings, we were unable to gain access to sufficiently detailed lecture recoding usage data to carry out any meaningful analysis.

We had also planned to use the FILL+ data to compare the learning outcomes of students who had experienced different levels of interactivity in lectures. One large course in our sample offered a natural experiment as it was "double taught", i.e. lectures were given twice by the same lecturer, for different halves of the class each time. Moreover, we had access to good attendance data and exam results for questions on topics covered in different lectures. However, our analysis of these lectures found that the two versions of the lecture were very similar in style, so there was little scope to say anything about the effect of a difference in approach on student outcomes.

We have also started pilot work to return to lecturers with their FILL+ data, and explore the extent to which this helps them to reflect on their teaching.

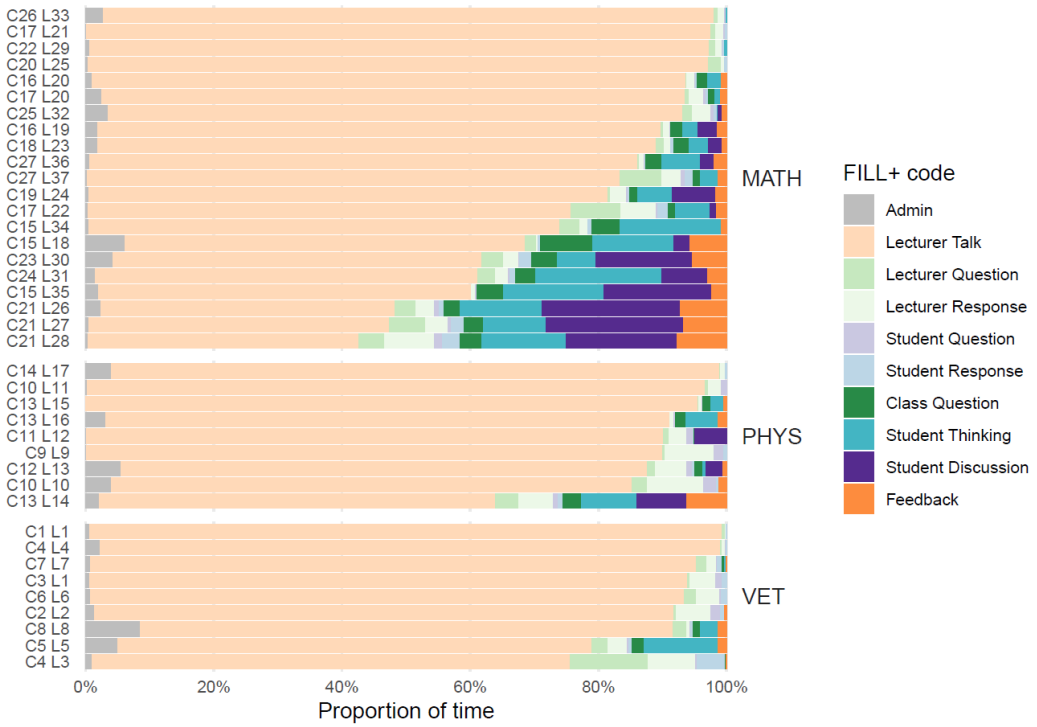

Figure 1: Proportion of lecture time allocated to each FILL+ code, for each lecturer-course combination in our sample *[from Kinnear et al. (in press)]*.

How did you disseminate your findings?

Conference and seminar talks

"Reliable classification of classroom practices using lecture recordings", BSRLM, Belfast 9 November 2019, https://bsrlm.org.uk/previous-conferences/

"Reliable classification of classroom practices using lecture recordings", Electronic Seminar on Mathematics Education, Online, 26 May 2020, https://math.mit.edu/seminars/esme/pastseminars.html

"Reliable classification of classroom practices using lecture recordings", University of Edinburgh Learning and Teaching Conference 2020, Online, 25 June 2020, https://edin.ac/330fPOH

"Reliable classification of classroom practices using lecture recordings", TEMSE Seminar, University of Edinburgh, 29 October 2020, https://stack-demo.maths.ed.ac.uk/demo/course/view.php?id=30&section=4

"Lecturers' use of questions in undergraduate mathematics lectures", BSRLM, Online, 14 November 2020, https://bsrlm.org.uk/previous-conferences/

Written outputs

Anderson, R., & Gant, T. (2019). *Characterising teaching practices using lecture recordings*. Teaching Matters blog. https://www.teaching-matters-blog.ed.ac.uk/characterising-teaching-practices-using-lecture-recordings/

Kinnear, G., Smith, S., Anderson, R., Gant, T., MacKay, J. R. D., Docherty, P., Rhind, S., Galloway, R. (in press). "Developing the FILL+ tool to reliably classify classroom practices using lecture recordings". *Journal for STEM Education Research*. DOI: 10.1007/s41979-020-00047-7. Preprint available at: https://doi.org/10.31219/osf.io/7n6qt

Kinnear, G., Hood, G., Lardet, E., Sheard, C., Foster, C. (in preparation). "Lecturers' use of questions in undergraduate mathematics lectures"

Smith, S., Anderson, R., Gant, T., & Kinnear, G. (2020). FILL+ Training Manual. URL: https://doi.org/10.17605/OSF.IO/27863

What have been the benefits to student learning?

The five undergraduate research assistants employed on the project all found this a valuable experience, giving them insight into research practices (see e.g. Anderson & Gant, 2019). All will be co-authors on at least one journal publication based on their contribution.

More widely, the data from this project will be the basis for ongoing work to engage with lecturers about their teaching practices. Our pilot work has already established that several lecturers have found it helpful to engage with this data as they reflect on their approaches and thereby benefit students' learning.

How could these benefits be extended to other parts of the university?

We have shown that the FILL+ protocol can be applied reliably following minimal training, and have provided a training manual (Smith et al., 2020) to help with this. We would be very interested to work with other parts of the university on using this approach to analyse lectures in different disciplines.

References

Eddy, S. L., Converse, M., & Wenderoth, M. P. (2015). PORTAAL: A Classroom Observation Tool Assessing Evidence-Based Teaching Practices for Active Learning in Large Science, Technology, Engineering, and Mathematics Classes. *CBE--Life Sciences Education*, *14*(2), ar23. https://doi.org/10.1187/cbe.14-06-0095

Paoletti, T., Krupnik, V., Papadopoulos, D., Olsen, J., Fukawa-Connelly, T., & Weber, K. (2018). Teacher questioning and invitations to participate in advanced mathematics lectures. *Educational Studies in Mathematics*, *98*(1), 1–17. https://doi.org/10.1007/s10649-018-9807-6

Smith, M. K., Jones, F. H. M., Gilbert, S. L., & Wieman, C. E. (2013). The Classroom Observation Protocol for Undergraduate STEM (COPUS): a new instrument to characterize university STEM classroom practices. *CBE Life Sciences Education*, *12*(4), 618–627. https://doi.org/10.1187/cbe.13-08-0154

Wood, A. K., Galloway, R. K., Donnelly, R., & Hardy, J. (2016). Characterizing interactive engagement activities in a flipped introductory physics class. *Physical Review Physics Education Research*, *12*(1), 010140. https://doi.org/10.1103/PhysRevPhysEducRes.12.010140

Financial statement:

This project has utilised the funding awarded to it by the PTAS adjudication committee and the Principal Investigator or School Administrator appropriate can provide financial statements showing the funding usage as and when required by the UoE Development Trusts who may require it for auditing purposes.