

Summative Assessment of Mathematics at University

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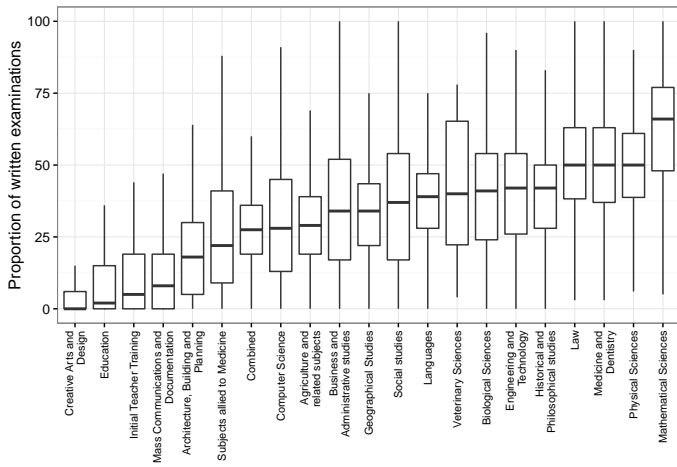
Projects on summative assessment of mathematics at university

- 2010: Validity and value of forms of assessment in mathematics at university level
- 2011: MU - MAP Mapping University Mathematics Assessment Practices
<http://www.uea.ac.uk/education/mumap>
- 2012: PAMPER: Performance Assessment in Mathematics - Preliminary Empirical Research.
- 2014-15: Comparing education and mathematics students perceptions of summative assessment

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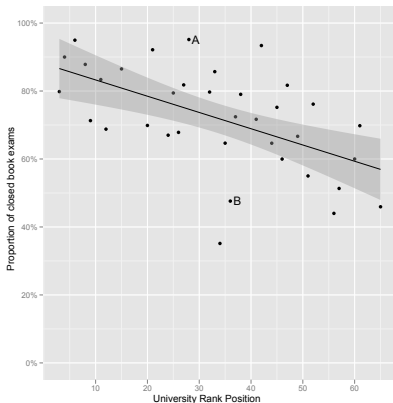
A first observation

Assessment patterns across disciplines vary considerably. Simpson (2015) noticed that the BSc mathematics has the highest proportion of written exams in its assessment diet (by assessment diet I mean the whole pattern of assessment across the 3 years):



A second observation

Robust data from 43 BSc Mathematics (G100) degrees in England and Wales (1843 modules) shows that if we map the percentage of credits accrued through closed book assessment against the position of the universities in one (arbitrarily chosen) university league table we have



In the meantime . . .

The scholarly literature on assessment in mathematics at UG level calls for innovations - following the calls from the general HE literature. In the HE literature there is strong evidence that students' perceptions of assessment are linked to their engagement with the material (deep or surface learning) and that students strongly prefer innovative assessment methods as they see them more relevant, fairer.

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Normal assessment was seen as a necessary evil that allowed them [the students] to accrue marks. The accompanying activities are described in terms of routine, dull artificial behaviour. Traditional assessment is believed to be inappropriate as a measure, because it appeared simply to measure memory, or in case of essay-writing tasks, to measure ability to marshal lists of facts and details. Alternative assessment was believed to be fairer, because by contrast, it appeared to measure qualities, skills and competences which would be valuable in contexts other than the immediate context of assessment.

(Sambell et al., 1997)

In the meantime . . .

Some of us have also experienced pressures from outside mathematics departments to change the mathematics degree assessment diet to follow what the general HE literature suggests in the general understanding that **new** is equivalent to **better**.

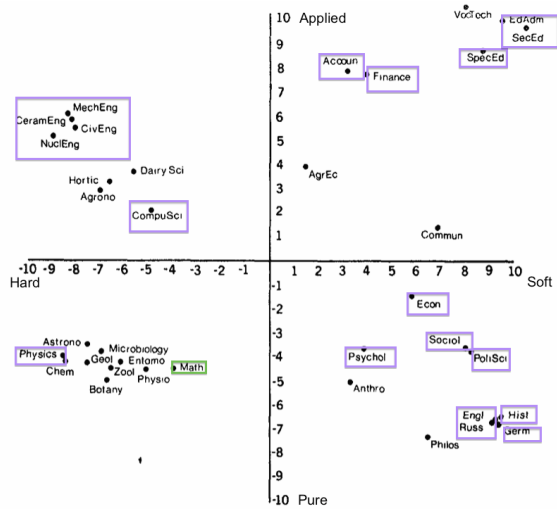
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Some of us have also experienced pressures from outside mathematics departments to change the mathematics degree assessment diet to follow what the general HE literature suggests in the general understanding that **new** is equivalent to **better**.

. . . but there is a caveat . . .

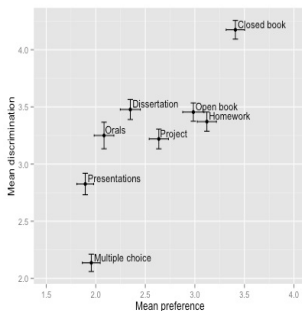
Very few studies have investigated the views of students in the hard-pure sciences (Biglan, 1973) and none the views of mathematics students.

Biglan - 1973



A study

We (Iannone and Simpson, 2013, 2014) asked mathematics students at two universities in the UK about their perceptions of summative assessment. Mixed method study - a survey (N= 114) and 12 semi-structured interviews with students volunteers. The survey asked two questions concerning preference of assessment and discriminator of ability from a list of 8 assessment methods in use in mathematics.



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- Mathematics students prefer to be assessed by methods they perceive to be good discriminators of ability
- Mathematics students prefer traditional assessment methods such as closed book examination as they perceive them to be fairer than innovative methods
- They perceive traditional methods as the best discriminators of mathematical ability

Some findings - from the interview data

- Students give great consideration to the assessment diet across their degree course:

I would probably take an approach which used a variety of different systems and I would probably do it in a more equal manner to how it is done here and I imagine at most other universities. I would probably have a greater presentation based element. I would probably have some coursework stuff other than the project in the final year.

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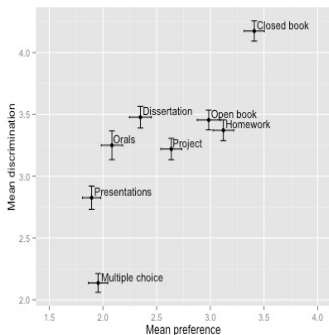
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- Students are open to innovations - but those need to make sense for mathematics

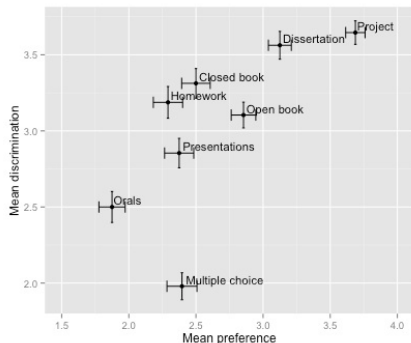
I'd like to see some kind of way for them [the lecturers, to assess you] either with written pieces, or through actually talking to you. Maybe a meeting with an advisor, just a short meeting to discuss and ask questions and they could give you a mark, for like a small percent of the module, maybe only like five or ten percent, just for them to see how much you understand. (Sarah)

How do these views compare to the views of students in other disciplines?

We conducted a replica study (Iannone and Simpson, in press) - same methods, same university but participants were students on a BA Education. The results are very interesting:



Mathematics



Education

Of course there are many open questions

- What influences students' perceptions of summative assessment?
- Why do they appear so different across disciplines?
- What is the role of the institution (e.g. the ethos of the university for example) on such perceptions?
- What is the role of the students' background on such perceptions?

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But there are other considerations:

- What is the main use of summative assessment? Or what do we want summative assessment to tell us?
- What about the ever ubiquitous employability skills?
- How can we balance the considerations of the need of mathematics as an academic discipline, those of the students and those of mathematicians?

There is some tension - in words of a mathematician:

From a study a while back (Iannone and Nardi, 2005)

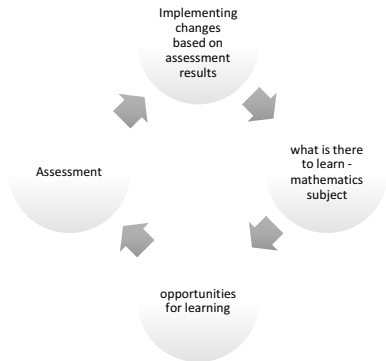
I think there is a huge problem with the idea that . . . these sheets are, you know, I never understood why they used them to . . . attain marks where in fact we want to use them to teach mathematics. These are two completely different things. We use them to obtain marks, to test knowledge and to teach mathematics. [. . .] it is absurd that this student gets two out of ten and this student gets seven out of ten and that is carried forward to their marks in the course. That is absurd. The three out of ten person has done a fantastic job, they observe that they don't understand this so we have an opportunity to teach the maths, and maybe they should get the seven! (a mathematician)

Assessment for learning (AfL)

Assessment for learning is assessment that:

- Aims at informing teaching
- Aims at informing learning
- Is characterised by formative feedback
- (Can) carry marks

But it must also be suitable to assess mathematics!



Assessment cycle

One candidate: Oral assessment

The education literature (Joughin (2010)) distinguishes between three types of oral assessment:

- Clinical assessment (e.g. role play for trainee doctors)
- Presentations (may be followed by a Q&A session)
- **Oral performance assessment:** It involves assessing knowledge and understanding with elements of both presentation and dialogue, it is somewhat decontextualised, has a relatively open structure and combines oral medium with writing on a board.

In a study (Iannone and Simpson, 2012, 2014) we implemented oral performance assessment in a year 1 graph theory module to replace one of the weekly coursework sheets. We have reported in Iannone and Simpson (2012) issues of implementation. The study consisted in a questionnaire and 19 semi-structured interviews with students who had participated in the oral assessment.

And about the time involved

The module was taught by one lecturer and 2 PhD students (who took most of the seminars and took the oral assessment as well) and had 108 students on role. The seminars for this module have 8 groups - each comprising 12-15 students. The PhD students told us that it would take about one hour to mark the coursework for one group. So the seminar/assessment cycle would take 16 hours (without counting the time needed to answer students' queries etc).

The oral assessment took $108 \times 10 = 18$ hours - so not that much more than the usual time devoted to a seminar cycle.

Findings

Themes emerging from the interviews comprised:

- Anxiety - for a medium that was not familiar to these students
- Fairness - amongst other things students noticed that it is impossible to plagiarise in an oral assessment
- Understanding
 - Of the assessor: regarding what the student can do
 - Of the students: due to the immediacy of the feedback
- Authenticity - for the students this assessment reflected what a real work situation would be like.

It was also noted that oral assessment sits well with the internationalisation agenda: international students are in the position of being able to ask questions if the language becomes a barrier.

Since then . . .

I have used oral performance assessment in a problem solving module I use to teach in my previous institution (University of East Anglia) for the past two years. I worked with 3 other mathematicians and they were very positive about this experience.

They often commented on how oral assessment helps them understand how much the students actually know - and they were surprised by this.

Thank you