Does assessment diversification improve achievement and satisfaction in Mathematics education?

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Background

Assessment is a crucial part of learning, allowing students to evaluate their understanding and identify areas for improvement. Assessment diversification can positively affect students, allowing for the expression of learning in different ways, supporting the development of broader skills, and improving engagement in classes. I would like to test this hypothesis in an empirical research project, using data from LSE Mathematics courses to draw conclusions.

I focus on mathematics courses for several reasons. Firstly, they are taken across the undergraduate body; hence, an improvement in the provision of mathematics courses can improve the learning experience for a large range of students. Secondly, mathematics education comes with several unique challenges, such as the significant transition from school maths to university maths. Thirdly, satisfaction in the Department of Mathematics is relatively low when compared to other departments. For instance, in the NSS 2020 Executive Summary, satisfaction across the Department is noted as 'poor but improving.' Finally, assessment in the Department is heavily exam-oriented; however, some courses have recently incorporated an element of continuous assessment.

I primarily intend to investigate whether a diversified assessment format (that is, assessed in a manner that is not solely a final examination) impacts student achievement and/or satisfaction. Based on this research, the Department of Mathematics may be able to take steps towards improving student learning, satisfaction, and engagement.

Methodology and Data I

I analysed a dataset provided by LSE Data Management Plan team. The dataset contained the anonymised results of all students who had taken a Mathematics course since the 2016/2017 academic year. In addition to the module mark and the grade classification, there was also information on degree programme, module code, year of study, gender, and satisfaction. Once restricted to Mathematics students, there were 4689 entries in the dataset, outlining results for 707 different students. All data analysis was performed on Stata with standard fixed effects; the code and the output tables can be provided on request.

Firstly, I performed an **across-years regression**. Here, I restricted the analysis to courses that were eventually diversified in their assessment structure (MA103, MA208, MA210, MA211, MA300 and MA301). I wanted to see whether students performed better and were more satisfied in courses once they were diversified.

Secondly, I performed a **within-year regression**. Here, I restricted the analysis to second- and third-year students in the 2020-2021 academic year who took a mixture of diversified and non-diversified courses (MA209, MA212, MA316, MA317, MA319, MA320, MA321, MA322). Note that I controlled for students' first-year results. I wanted to examine whether the relative performance was higher for the same student in their diversified courses relative to their non-diversified courses, controlling for prior ability.

Findings and Limitations I

- The regressions yielded **positive but statistically insignificant coefficients** for both academic achievement and student satisfaction, across years and within the 2020-2021 academic year.
- This indicates that diversified courses **may yield a positive effect, but not at the 5% significance level**. Hence, there is no significant impact on either of the variables of interest: student achievement or student satisfaction.
- Limitation: note that there were few responses for student satisfaction (243/707, or 34.3%) and that the student satisfaction measure was for their programme. Therefore, it is not a reflection of satisfaction for a given module.
- Limitation: the COVID pandemic had a distorting effect on results (usually upwards distorted). However, most modules which had coursework components introduced the new format during the 2020-2021 academic year. Hence, **the (insignificant) coefficients determined are likely overestimates.**

Methodology and Data II

To supplement the regression results, I conducted brief, semi-structured interviews with six students. These were all anonymous, with two third-year students (one male-identifying and one female-identifying) from each program within the Department of Mathematics. All students have taken at least one course with a graded coursework component. This was either a project or a coursework completion grade, worth at least 10% of the final grade.

I asked the students the following four questions:

- Did you consider whether a module was diversified in it assessment structure when you selected it?
- Would you say the presence of an assessed coursework component increased your satisfaction with a module, or not?
- Would you say the presence of an assessed coursework component aided your learning with a module, or not?
- Would you say the presence of an assessed coursework component aided your participation in classes and/or lectures for a given module?

Findings II

- In general, students preferred diversified courses. They felt incentivized to stay on top of material and felt more prepared for revision periods:

    - *"Assessed coursework forced me to stay on top of weekly content – I had to watch the lectures and be somewhat ok with the content each week, and when April came, I felt more ok with everything."*
    - *"The 10% was the only reason I watched lectures every week all the way until the end of term."*
- Students felt coursework completion credit reduced pressure during examination season:
    - *"I come from a country where 100% exams almost never happen, and I think the amount of stress it puts students under is terrible. It also means that some students won't care about the classes or lectures until revision time."*
    - *"I was really surprised when econ courses had marked coursework last year. I felt so much better for my exams."*
- All students surveyed strongly preferred a completion-mark coursework component (e.g. 10% of the grade if all problem sets are submitted to a reasonable standard); preferences for project work varied amongst students depending on where their strengths lay.
    - *"I'm not sure how I feel about all courses having a project, it adds a lot of stress, especially towards the end of term which is already hectic. Having projects due during exams is also stressful."*
    - *"I personally enjoy projects, but I know some people who don't like them. I think in mathematics, it's good to look at applications."*
- Whether or not a course was diversified played mattered to some extent for course selection.
    - *"I cared a bit this year… wouldn't be the only reason I chose a course but if I was tied between two, I would go for the course which gives credit for completed homework."*
    - *"I picked [course] purely for the project, I think because we write so many exams, it's good to make sure that we have other grades that we can rely on outside of exams."*
- While students recognized that there could be disincentive effects, they generally believed that diversification in module grading did not deter them from preparing for exams.
    - *"I think there's a risk of feeling that false safety – like, it's not hard to get the completion grade and so you might think you're stronger in the material than you really are, or you might slack off on studying because you have an extra few percent. I don't really see that happening though."*
    - *"I got scared that [the course convenor] might make the exam more difficult to compensate, but I also felt more ready for a hard exam…. I guess it evens out."*
- Some students noted that it could help promote participation in classes
    - *"I realized that I wasn't participating in class when I fell behind in the homework, because I felt that I could not speak or ask questions in class. And so, I would eventually stop going to class, because it just didn't make sense to go."*

- *"I'm not sure if it encourages us to participate, but it makes it less scary, because at least you have your attempt at the problem set right in front of you. There's something to say if the teacher asks."*

Results summary

- There is a positive, but insignificant, impact of diversified assessment methods on achievement, as measured through module marks.
- There is a positive, but insignificant, impact of diversified assessment methods on student satisfaction; however, this may not be due to the diversification of a given module itself (I was only provided with programme satisfaction scores).
- It is fair to say that from the data we have access to, the introduction of diversified assessment methods does not distort grade results in mathematics. A distortion (such as a large increase in students receiving high grades) may not be in the best interests of the department.
- However, from semi-structured interviews, we can see that students feel more prepared and less stressed, as continuous assessment methods promote learning throughout the term.
- **Hence, introducing diversified assessments can reassure and support students, while preventing large grade distortions.**

Recommendations

- Consideration of **instituting some form of continuous assessment across all courses**, with preference for a coursework completion grade (e.g. good effort on most problem sets across a term allowing students to achieve a small percentage of the final grade).
- Discussion of scheduling of continuous assessment/project work to minimize the amount deadlines at the end of term.
- Given how recent most diversified modules are, requesting **opinions of students in diversified modules in TQARO surveys**, to provide the department with more comprehensive feedback.