

Alternative Approaches to Examinations in the Mathematical Sciences: Results from the Survey

20 March 2020

Overview

Due to Covid-19 (Coronavirus) universities are needing to make changes to how they deliver their traditional examinations, with many looking to make the transition to 'online delivery'. There is a lot of discussion about what this might mean for departments of mathematical sciences and so the purpose of this short survey was to capture current departmental thinking and share this within the community with a view to assisting each other in our examination planning during these difficult times. All responses to this survey were deliberately collected anonymously on the 19/20 March 2020.

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and with thanks to all Heads of Department who responded.

Q1. What is your current University policy on examinations in relation to Covid-19? [30 Responses]

Summary

1. It is evident that universities are at very different points in planning for alternatives to a traditional summer examination period. 13 out of the 30 responses indicated that no clear institutional plans were in place, although for some ideas were beginning to emerge and be communicated to departments.
2. Almost all indicated that no traditional on-campus examinations were scheduled to take place, even if delayed from the traditional summer period. One indicated exams may move to September, but this was in an institution where plans were continuing to emerge.
3. Where institutional plans were in place, or developing, the vast majority of respondents indicated that the traditional exams would be replaced by some other assessment means. Respondents indicated that this will involve students completing some form of assessment at home, or changing examinations to coursework/projects. Two respondents mentioned exams were cancelled altogether and another mentioned cancelling assessment where possible; in one of the institutions where exams were cancelled, progression and award decisions are to be based on previous examination results and continuous assessments.
4. Only four respondents indicated that they had flexibility to design alternative approaches at a departmental level. A further three indicated their institutions were adopting a different approach between academic years with a possibly 'lighter-touch' approach in earlier years.
5. A number of respondents indicated that the online exams would be available to students over an extended period for completion. 24 or 48 hours was mentioned, but up to 7 days was indicated by other respondents.
6. Only one department mentioned calibrating results of the online exams with previous student performance.

Full Dataset

1. No decision yet made

- *None yet. University decision expected today (Thursday).*
- *There isn't one at the moment.*
- *Not yet determined -- but leaning toward remote/online exams at the previously scheduled time.*
- *Undetermined, it will be decided next week after a period of swapping ideas.*
- *Our University does not yet have a policy...It is not clear if we decide that due to the technical nature of maths exams that it is not possible to hold secure and fair online exams, whether this will be heeded.*

- *It's still being decided.*
- *Not decided!*
- *Nothing specific yet, but will probably give students 24-48h window to do exams at home.*
- *On campus exams are definitely cancelled. The University is still to decide on a replacement plan.*
- *Undecided.*
- *Currently under discussion. Likelihood is that students will take exams at home, timed, and upload answers online. There is an option to allow a longer time (5 days) if appropriate. We are planning to compare results with data from previous years to ensure as far as possible fairness for students and quality.*
- *The centre has just come out with a vague statement saying that the exams will take place online, without having any idea of what this actually involves. We are presumably meant to magic up some sort of solution to this.*
- *Traditional exams are cancelled, to be replaced by online assessment in some (unspecified) form. Policy on assessment will be communicated to schools on 20th and schools to communicate to students early next week (giving us no time to make any sort of considered response).*
- *Not entirely clear and changing at speed.*

2. Replacement with some alternative form of remote or online assessment, including replacing exams with coursework

- *Exams to be replaced with alternative assessments that can be done remotely.*
- *We are to post exams on Moodle in-line with some sort of timetable and students are to do them at home and upload them in pdf form within seven days*
- *All exams, where possible and being changed to courseworks, but using existing examinations. So students will need to create 'model answers' suggested timescale of a week.*
- *They will be replaced by an end of module assessment (EMA), which the student will complete at home.*
- *All assessments have been temporarily suspended. Online assessments are in the offing at the end of semester 2 instead of examinations.*
- *No exams will take place on campus. Assessments will happen remotely after Easter.*
- *No sit-down exams will take place. These will be replaced either by coursework or a timed release of an exam paper to be done and uploaded to our VLE.*
- *Online 24-hour exams for some modules, cancel assessment where possible.*
- *Replace exams which are critical for the degree classification by online exams, or where possible by projects.*
- *Cancel face-to-face exams and replace by some form of (un-invigilated) "take home" exam.*

3. Cancellation of (summer main sit) examinations

- *All exams have been cancelled for the rest of the academic year.*

- *Exams are cancelled in April/May. The University allows options for online assessment where appropriate. The technical nature of the examinations in mathematics means that it was not possible to implement a secure and fair online examination at such short notice. We will base progression and award on available results in previous exam sessions and completed continuous assessment.*

4. A differential approach to alternative assessments between years

- *No physical exams. Light touch assessment for continuing students e.g. extended coursework or e-assessment. Finalists will have a variety of summative assessments, many of which will not be open or closed book exams. We are in conversation with the Institute and Faculty of Actuaries about complying with their requirements for accreditation for modules contributing to IFoA exemptions.*
- *At the moment: for years 2/3/4 exams will continue in some form, but probably not for FY and year 1. The current suggestion for years 2/3/4 is to run open book exams which will be available for 24 hours (but with instructions that students should only spend x hours doing them).*

5. Flexibility within the institution to determine a disciplinary approach

- *Programme-by-programme discussion to develop alternative assessment items.*
- *Departments have been asked to develop their plans but feedback through the Faculty Academic Director.*
- *Exams in May/June will not be sit down exams. Schools & departments are responsible for creating their own alternative assessments to the May exams. No policy as yet on the August resits. Some talk about doing exams in September, but no official word on this.*
- *Some flexibility, but primarily replace the invigilated summer exams with alternative online assessments.*

Q2. What would be your proposed (ideal) approach for mathematics? [28 Responses. One of which was just?]

Summary

1. Of the 28 responses, 7 had a preference for delaying exams until a later date (with the dates ranging from the traditional August resit time, to next year or until it is safe to have them).
2. 21 respondents had a preference for online examinations of some type.
3. There is some overlap with these respondents as some of them gave an ordering of the two preferences.
4. Amongst the online examination responses, the preference is for short timed exams of a few hours with extra time to allow scanning/photographing and uploading.
5. Different procedures between students in different years are considered with some saying that first years should just be progressed.
6. A number mentioned randomisation of questions and though these were considered good for computational questions they were thought unsuitable for pure mathematics.

Full Data Set

1. Postponement

- *Exams at a later date - but this would have a severe impact on progression and award.*
- *I don't believe that it is possible to have fair and secure online maths exams, particularly for high-stakes honours exams. Some of our students are from very deprived backgrounds and don't even have access to a quiet place to work, let alone computers or reliable internet (and school closures will only make this worse). Others are very wealthy and have access to private tutors and/or sophisticated mathematical software that can solve many exam-style problems, often also providing intermediate steps. Given this, I think that online exams will provide less reliable information than we already have, and should not take place.*
- *Progression and award decisions should either be made on the basis of existing information, or if that is not feasible then the assessment should be delayed until it can safely take place.*
- *For year 2 (this is the hardest one)- delay exams till September/October, or January or May.*
- *Postpone exams until September, and if necessary delay the start of term. Students who fail should be allowed to retake without charge.*
- *Honestly - get the students in to do written exams if possible (even if they are postponed a little) given they are still months away for us.*
- *Delay exams and sit as usual later. 2nd preference, small project pieces.*
- *It is impossible to imagine that a traditional mathematics exam could be done online. The main issue would be security. By their very nature it would far too easy to cheat with students contacting each other while the exam took place. Our proposed approach is to cancel May exams and hope to use the Aug resit diet.*

- *a) postpone examination b) Online exams in form of short questions /answers, which can be filled in online and are randomised, with a strict time limit.*

2. Remote Open Book Timed Exams

- *Looking at "open book" timed exams conducted remotely via Blackboard.*
- *Our default position for each module is to replace each exam with an online exam based on the existing paper but with appropriate modifications to make it suitable as an "open book" exam (since invigilation seems implausible).*
- *Open book timed assessments which are not invigilated.*
- *We had a discussion within Faculty.*
- *Faculty preferred option: exams as scheduled, with papers distributed through VLE. Students photographing and uploading work after completion. One extra hour to allow for upload.*
- *Adapt exams to be open book exams they can do at home.*
- *Possibly "Take Home" with x-day turnaround and e-submission.*
- *Online exams with a mixture of multiple choice or short answer questions and then several longer answer questions. The issue with this would be the infrastructure. My university [...] currently doesn't have the facilities for students to do this via our VLE (Moodle). However, it is not impossible.*
- *Given that we have a small year 3 cohort (~14) it has been suggested that we use Microsoft Teams to invigilate final year exams. Students will be given ~30 minutes extra to scan work (using a mobile phone app) and then upload to Blackboard.*
- *A timed exam. Sent out electronically at a given time for students to print, complete, scan, and send back electronically.*
- *So perhaps 4 hours to complete a 3 hour exam, scan it and send back.*
- *I don't think this is really our ideal approach, but more the approach that will be technologically feasible at our university. Basically as above [Section 3 of Q1 dataset] but in fact make the paper available for even longer (say a week) so that we end up with fewer students needing to claim ECs to do the exam again later. The most ideal would be to give timed release so that students can choose when they start the exam and then only get a much shorter time to do it (the usual exam time plus a little extra for technological problems and to scan/upload solutions) but we don't think our technology would allow that.*
- *Alternatively issue an 'online' exam - i.e. give the students 3 hours from the release time of the paper to their exam handwritten and then scan their answers in. The short time they will have should reduce the impact of any cheating.*
- *Online (released via Moodle) sits of a slightly modified version of our already set papers with a fairly tight time window (perhaps 3 hours instead of 2). Handwritten solutions uploaded as pdf to Moodle.*
- *Probably a mixture of e-assessment and open book*
- *A combination of computer based exams (for easy computational questions) and take home exams (new proofs, new examples of known methods).*
- *We have been using electronic submission of coursework via Blackboard (all Year 1-2 and many of Year 3-4 modules) where students take photos of the answer sheets, use an app*

to create a pdf which they submit to Blackboard Assignment. Our ideal approach would be to release the exams (as pdfs) in their current form (maybe re-weight to give fewer marks to questions that mostly rely on memory and more to problems, testing understanding etc.) for the duration of the exam (2-3 hours) plus 0.5-1 hour for preparing and submitting the pdf as discussed above. (if the upload speed is too low, or connection unstable, students may take more time to submit, but the pdf they create has the time stamp, so we can verify the time the finished writing the exam + 15-20min for taking photos of 10-15pages and creating the pdf). We would give students a chance to practice the submission process on a mock Bb assignment. The release time would be the same in all time zones (not ideal, but otherwise it would be too easy for students, say in China, to e-mail the exam to their classmates in the later time zones).

3. Differences between students

- *See answer to [Section 5 of Q1 dataset] - a combination of approaches.*
- *For Level 1, take-home paper assessed on a pass-fail basis.*
- *cancel assessments for year 1 - let them progress, since marks do not count towards final degree.*
- *For year 3 BSc and year 4 MMath - calculate degree classes with already known marks (and generous borderline algorithms).*
- *For year 3 MMath - allow automatic progression. Calculate degree class next year based on available marks.*
- *Model answers for year 0, 1 and 2, but timescale of a day. [sic]*
- *1st year: online multiple choice quizzes; other years: open book exams open online for 2-3 hours.*
- *Pass those on intermediate stages based on results thus far. Online randomised assessments for applied modules for graduating students. Use August resit period for other modules. This delays graduation but in the current climate seems acceptable.*
- *Depends on the level.*

4. Plagiarism

- *The key concern is the possibility of plagiarism. We are considering ideas such as different papers for different students (e.g. automated, with numbers in questions generated automatically from student numbers), or follow up vivas after the exams. All such ideas are problematical though, for various reasons.*

5. Other comments

- *There isn't one. We have to be aware that students taking exams at home will have a lot of difficulties (eg they may be doing an exam in a room with younger siblings playing as there is nowhere else for them!).*
- *Randomised online quiz questions would overcome concerns about plagiarism but for many pure maths or higher level subjects it is hard to assess longer arguments/proofs.*

Q3. To what extent are you proposing to modify existing papers? **[30 Responses]**

Summary

1. Extent: most respondents said "very little" or "as little as possible", but some suggested a complete re-write.
2. Format: most respondents who mentioned format have a working assumption of turning existing exams into open book exams, but some will use CAA.
3. A number of colleagues sought guidance on how to change papers to open book, with concern about what to do about collusion/plagiarism.
4. The nature of academic changes is closely linked to the format and university policy, so this is difficult to separate out cleanly in a summary.
5. 9/30 respondents explicitly acknowledged the need to reduce bookwork in exams, or take account of the availability of notes.
6. 3/30 respondents suggested the need to move to more open ended "extended coursework" assignments.
7. Given an exam paper is written carefully with a context in mind, i.e. conditions and materials available, there is considerable uncertainty about what to do with exams, with many people waiting for university policy decisions.

Full Dataset

1. Extent

- *Very little, due to the increased workload for staff, moderators and external examiners.*
- *As little as possible.*
- *Many exams will stay as they are.*
- *This is a University decision, but leaning toward no modifications.*
- *Exam papers had not been written.*
- *Our initial option is to get the exams cancelled. If we are forced to put the exams online then I know staff are not going to be happy rewriting exam papers.*
- *Existing papers have to be completely rewritten.*

2. Format

- *We are proposing to do take away exams, and students will be given 2 days to complete them.*
- *In some cases the exam papers will be modified to be open book "take home" exams.*
- *We are, conscious of the fact that exams will be de facto open book.*
- *Recast some as online quiz assessments.*
- *We are also considering use of CAA for some modules.*

3. Nature of academic changes

- *Reducing the amount of "Bookwork"/factual recall style questions. Remove majority of bookwork parts of questions.*
- *We would have to remove any book work type questions, for obvious reasons. Considering if it is feasible to randomise parts of papers to discourage unfair practice.*
- *If an exam has a large 'bookwork' component, then we can take that account in the marking/moderating process.*
- *I will have to remove bookwork parts of questions: definitions; standard proofs etc.*
- *mostly we would change the markscheme to make the bookwork parts worth less; we might add a bit on to some questions, and remove entire questions if they are completely bookwork, but relatively little change if at all possible.*
- *Where online exam is the plan, we will reduce (but not eliminate) bookwork. Concerned about effect on weaker students.*
- *Remove bookwork elements.*
- *Amend as required to make suitable for students who will have access to their notes and other online resource.*
- *Would have to recognise that notes and other materials would be available.*
- *In most cases the final assessment will most likely be more like an extended coursework assignment.*
- *Some exams are being modified to make them more like coursework type questions (exam questions tend to be easier due to the students having to remember methods etc).*
- *Adding an open style compulsory question overarching to the content of the unit at the end of the existing papers, worth 20%, to compensate for the fact that the existing paper is moving from closed to open book and to allow the examiners to differentiate between candidates in a meaningful way. The learning objectives are met by this route as the existing papers already ticked that box.*
- *Focus strongly on LOs not already covered or showed weak outcomes from earlier in-year assessments.*
- *We have suggested we focus more on the material that was taught face to face rather than the whole syllabus*
- *Given the time it will take the central exams team to make arrangements, this is urgent and we want to avoid causing unnecessary work and risking errors.*
- *We are identifying papers where we don't think any change is necessary.*

4. University policy

- *Under discussion.*
- *This depends on the approach taken by the University. At the moment, staff have not been asked to amend papers, but they have been asked to prepare for being asked.*
- *It will depend on the steer from the University.*

5. Uncertainty!

- *I have absolutely no idea how we could set exams that are suitable to be taken online. If our management insists on us doing this, then I don't even know where to start.*

- *Some will need a lot more changes than others, but it depends what the university asks us to do.*
- *until the university centre tells us what to do, we don't know what will be allowed / permitted.*
- *We haven't got this far yet.*
- *Not as yet, but this depends on the final direction of travel.*
- *Undecided given no decision has been made.*

6. Concerns

- *Our staff are not prepared to spend much time modifying the papers now, so if we are not allowed to take the 'ideal' route and are forced to release the papers for 24-48h, then we expect high levels of collusion and almost perfect answers from all students.*
- *We are told that it would somehow be 'OK' and colleagues in other STEM departments seem to be more relaxed about this than us in maths.*
- *It is not at all obvious how certain material can be examined in non traditional ways. Expecting staff to find out how this might be done in a way again that is secure seems fanciful.*

Q4. Any other comments, thoughts or observations? [18 Responses – 4 non-specific comments not included below]

Summary

1. As is to be expected, several different themes were highlighted:
 - a. 5 respondents raised issues with the validity and reliability of approaches used to replace traditional examinations.
 - b. 5 respondents indicated there exist concerns for staff and student wellbeing during what will be a challenging, and unfamiliar situation.
 - c. 4 respondents expressed concerns in relation to possible student collusion.
 - d. 4 respondents expressed concerns in relation to the IT infrastructure required for successful online assessment.
2. Whilst two respondents indicated that this might be an opportunity to innovate in relation to assessment, another highlighted the challenges associated with online teaching delivery within the mathematical sciences. Another indicated concerns with the willingness of students to engage with online teaching content and the implications that this might have for the later stages of their studies.
3. As one respondent rightly noted, the debate has so far focused upon examinations, however a significant number of continuous assessments are also likely to have been cancelled; this has real implications when trying to calibrate overall student performance when alternatives to the traditional examination are used.

Full Dataset

1. Concerns with the validity of an online approach

- *They propose conditions (24-48h, similar to [Removed]) where the usual exam is essentially useless for testing individual knowledge and abilities, while we don't have time and manpower to develop proper open-book take-home exams.*

2. Issues associated with IT systems for online delivery

- *Not clear how to deal with students without access to IT facilities.*
- *I think the drive to going online assessment is fine for certain subjects but not mathematics. It is especially difficult to see how this can be done in a secure fashion. Some of our staff have found out this week the major problems students have using statistical software on student laptops/desktops. Some staff who were initially quite keen on online assessment have already changed their minds given the range of difficulties our students have installing and running software. We are worried that senior University management might just tell Maths and Stats to find an online solution even if it's apparent that there isn't a secure and fair way of doing this. I'm certainly interested if others have workable solutions to this issue.*

- *It seems that overall the administration is focussing on a few cases where students might have problems with lack of PC, wi-fi, etc., rather than preparing reasonable examination conditions for majority and then dealing with the few cases via mitigating circumstances.*

3. The risk of collusion

- *Students may collude or may treat the papers as open book exams but on the other hand they are very stressed so the advantage is probably cancelled out. Extraordinary times for all of us!*
- *There are serious issues with integrity, quality assurance and standards with online assessment -it is impossible to verify that the person at the keyboard is who they are supposed to be and is not in communication with others. Plagiarism cannot be prevented or detected.*
- *The proposal to allow students to do examinations at home undermines the academic credibility of our programmes. Examinations are necessary to test student knowledge of the topics covered, and to make sure that it is the students' own work. We know, from our coursework and essay modules, that some students cheat, and we would expect this to happen with examinations done at home. Further, examinations done at home may disadvantage some students who might not have a quiet area to work, or who have less access to other materials like books and internet access.*
- *Our university is very concerned about students in different time zones and therefore suggest 24h "take home" exams. I fear that this will be seen as an invitation to cheat.*

4. The need to be pragmatic

- *There is no perfect replacement for exams. We have to make the best of the circumstances and compromise.*
- *We have little choice but to fit in with general University arrangements even if these aren't ideal. We will be focusing in particular on fairness for graduating students.*
- *No solution seems perfect - we are aiming primarily to meet learning outcomes at programme level, on the understanding that it will be extremely challenging to do so in a robust way for every individual module.*

5. Out of adversity comes opportunity

- *This is a chance to be innovative and produce creative solutions that may serve us well in the future as a community.*
- *This is forcing us to think about how we teach, assess etc, which is a good thing.*

6. The wellbeing of staff and students

- *There is also a balance to be struck with student wellbeing - we want to assess every student fairly, and in a robust way that does not undermine academic integrity, but without unnecessarily adding to stress at what is a hugely difficult time for everyone. This is a very difficult balance to achieve.*
- *We should not require students to learn a new technology while stressed. We should think carefully about the time they have, and not give them more work than what they'd*

otherwise have. We should consider staff marking loads as well, particularly of those with caring responsibilities.

- *Our University is not likely to accept our suggestion as they wish for uniformity across the departments and most other subjects are probably aiming for 24-hour take-home exams. We have also suggested that all students are automatically awarded mitigating circumstances for this semesters exams.*

7. Engagement with online content and delivery

- *The difficulty we have is replicating face to face teaching with online alternatives that are as valuable for student learning. I have done distance learning of mathematics myself and it is SO much harder than if it is taught in proper classes/lectures.*
- *Current interaction with online resources is low. Concerns that this will impact later years if we can't assess somehow.*

8. Miscellaneous

- *Been impressed that academic staff are engaging with the changes on what is a relatively short timescale.*
- *Starting two years ago, we have a large coursework component (~30% on average). Many of these may also be affected as hand-in dates typically fall in the week after the Easter break.*