
Higher Education Teaching and Learning Series

ASSESSMENT STRATEGIES FOR MATHEMATICAL SCIENCES IN THE DIGITAL ERA



23rd June 2022

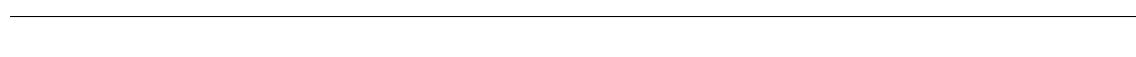
Glasgow



University of Glasgow | School of Mathematics & Statistics

**ROYAL
STATISTICAL
SOCIETY**
DATA | EVIDENCE | DECISIONS

 **Institute** of
mathematics
& its applications



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Developing assessment strategies for mathematical sciences in the digital era

Within the School of Mathematics and Statistics at the University of Glasgow, we strive to be at the forefront of utilising and developing technological advancements in our teaching delivery. With the recent pivot to online learning, the need for digital tools for technology enhanced learning has never been greater. We implement a variety of such tools across all of our programmes, most notably within our online distance learning MSc in Data Analytics where we have our own purpose built recording studio for creation of professional quality lectures and live sessions.

As part of our continuing development in using technology enhanced learning tools in our teaching delivery, the Statistics and Data Analytics Education group within the school are organising a workshop on assessment strategies for mathematical sciences in the digital era. This workshop forms part of the IMA & RSS Mathematical Sciences Teaching and Learning Workshop Series. This workshop aims to bring together researchers and practitioners from the mathematical sciences to discuss key issues about assessments and show/promote conditions in which deeper approaches to learning will flourish.

The workshop will consist of a series of keynote talks and demonstrations on the use of digital assessment approaches in the mathematical sciences.

We are delighted to welcome you to Glasgow for this workshop. The workshop will be held in the University of Glasgow, which is located in the beautiful and vibrant west end of the city. We hope you enjoy the workshop, the many sites that the city and surrounding area has to offer, and the famous Glasgow hospitality.

The organising committee - Eilidh, Marnie, Colette, Craig and Mitchum.

Sponsors

We are grateful to the IMA and the RSS for sponsoring the workshop.

Contact us

Email - stats-sdaeg@glasgow.ac.uk

Website - <https://www.gla.ac.uk/schools/mathematicsstatistics/research/stats/ai3/teaching/digitalassessment/>

Twitter - @UoGSDAEG

Venue

The workshop will be held at the University of Glasgow, in the heart of the cities' west end. The conference is held in the St Andrews building close University Avenue, near Kelvingrove park.

St Andrews building

- **Level 2 foyer** - lunches, tea / coffee breaks.
- **Room 227** - workshop sessions.



Programme

9:15 - 9:30 - Arrival

9:30 -10:00 - Welcome & ODL Overview (227).

Overview of Online Distance Learning programmes in Data Analytics at the University of Glasgow

Marnie Low, Eilidh Jack, Colette Mair, Craig Alexander, University of Glasgow

10:00 -10:45 - Keynote 1 (227).

Scaling up Assessment with Peer Review: Experiences from Online Learning

Jeremy Singer, University of Glasgow

10:45 - 11:15 - Tea / Coffee break (Foyer).

11:15 -12:15 - Keynote 2 (227).

Assessing first year statistics students using e-Tests and an end of module Project Week

Iain Weir, University of the West of England

12:15 -13:00 - Lightning Talks (227).

Lightning talks will be 5 minutes plus 2 minutes for questions

Are online quizzes like Wordle?

Lindsey Corson, University of Strathclyde

Prerecorded presentations as e-assessments in applied mathematics

David Rees Jones , University of St Andrews

Issues surrounding individual programming tests on large modules

James Grant, University of Lancaster

Online electronic assessment in a large undergraduate statistics module

Alena Haddley, University of Liverpool

Peer assessment via comparative judgement

David Sirl, University of Nottingham

13:00 - 14:00 - Lunch (Foyer).

14:00 - 14:45 - Keynote 3 (227).

Using STACK e-assessment in course design
George Kinnear, University of Edinburgh

14:45 - 15:15 - Tea / Coffee break (Foyer).

15:15 - 16:00 - Keynote 4 (227).

Student Peer Review using Aropä
Helen C. Purchase, University of Glasgow

16:00 - 16:15 - Close (227).

Abstracts

Keynote talks

Scaling up Assessment with Peer Review: Experiences from Online Learning

Jeremy Singer, University of Glasgow

If marking is our biggest headache, then peer assessment might be able to take away much of the the pain. In this talk, we will explore two different peer assessment activities on the FutureLearn and Coursera online platforms. We hope to demonstrate that peer assessment is (a) easy to set up and administer for educators, and (b) engaging and beneficial for learners. The approach scales to communities of thousands of learners.

Assessing first year statistics students using e-Tests and an end of module Project Week

Iain Weir, University of the West of England

The talk reports on a first-year statistics module with assessment that replaces the traditional forms of both coursework and exam. The objective of the module is to give students a grounding in statistics, including learning to use the SPSS package, and to ultimately apply the techniques learnt to an authentic large real-world data set during an end of module Project Week.

The learning and teaching strategy is centred on using key skill e-assessments to encourage students to self-learn. On accessing each e-assessment, students are presented with a randomly generated data set, which they are required to import into SPSS to then appropriately analyse and report on. Marking and feedback occurs automatically on submission and repeated use ensures that a student thoroughly learns a key skill and covers various analysis outcome scenarios, for instance significant or not significant test outcomes. Each key skill e-assessment has multiple embedded links to comprehensive Help pages that provide SPSS 'how-to' information or output interpretation. Access to these means that staff in the PC sessions can concentrate on giving higher-level support as opposed to merely helping with the mechanics of producing SPSS output. The e-assessments were created using the Dewis system, which is a fully algorithmic open-source e-assessment system. Dewis' ability to communicate with the R programming language facilitates the creation of authentic e-assessments, generating bespoke student data and providing answers that match SPSS screen output.

A series of in-class e-Tests sat under controlled conditions are distributed throughout the year to assess students' understanding of concepts and techniques together with their ability to apply them. Project Week is held after all teaching has been completed and replaces the traditional final exam. The week comprises a problem-based learning activity inspired by some consultancy the author performed for UWE. At the beginning of the week the students are given a client's brief before then authoring a questionnaire to collect suitable data to satisfy the clients requests. After this is submitted for assessment, the students are then each given their own bespoke simulated data

of 100+ responses to the actual questionnaire comprising 22 variables. Before Project Week students had yet to encounter such an authentic large data set that by design has many common problems embedded within it. These require the students to clean, screen and recode their data before a succession of bivariate and multivariate analyses are performed. Four checkpoint e-assessments are employed throughout the week; these are not just for a summative contribution to the overall Project Week assessment, but also for student feedback and feedforward. Thus, the progress throughout the week can be monitored and students that did not get all checkpoint answers were invited to one-to-one Help meetings to correct their mistakes. This ensured that their main deliverable of a written report contained accurate analyses.

Using STACK e-assessment in course design

George Kinnear, University of Edinburgh

I will give an overview of the features of the STACK e-assessment system, which has been specially designed to support mathematics assessment. I will show various examples of how STACK can be used in course design, with a particular focus on the course Fundamentals of Algebra and Calculus. I led the development of this fully online course in 2018: it has been successful in addressing an attainment gap in our Year 1 cohort, and the underpinning ideas have since informed the design of several other courses.

Student Peer Review using Aropä

Helen C. Purchase, University of Glasgow

Student peer review is an assessment activity whereby students mark or comment on other students' work. It has been shown to be beneficial to students - particularly in the development of transferrable skills like critical analysis, communication and reflection. Developed by *academics for academics*, the Aropä system has supported online peer-review activities world-wide for over twelve years, enabling instructors to benefit from the educational experience of its founders. Aropä has been used for subjects as diverse as archaeology and accounting, physics and politics, and, of course, statistics. In this seminar, I will describe the student peer-review process and how it is facilitated within Aropä, commenting on the nature and form of typical peer review assessments, and issues that arise for both students and instructors.

Lightning Talks

Are online quizzes like Wordle?

Lindsey Corson, University of Strathclyde

As asynchronous computer-enabled feedback becomes a key component of university teaching, it is increasingly important to develop robust models of how students understand it and how they engage with it. We describe various patterns of student engagement with low-stakes STACK quizzes in an introductory university mathematics module. Some of these patterns at first seem irrational and suggest that students have not grasped the formative or summative purposes of these quizzes. We suggest, however that these patterns of engagement make sense if we view quizzes as a form of game, which students meet on the same devices and the same terms as recreational games with which they are already familiar. (The virally popular Wordle is a prominent recent example.) In this light, different patterns of engagement reflect students' different expectations of the reward structure of games – implicit expectations which may override explicit instructions and the explicit demands of the module. We propose that this way of viewing engagement offers the chance to deploy quizzes more effectively, moving beyond simplistic claims that "gamification makes learning fun" and drawing on existing work on learner motivation and self-regulation using feedback.

Prerecorded presentations as e-assessments in applied mathematics

David Rees Jones , University of St Andrews

During the pandemic, we developed the use of prerecorded presentations as a type of continuous assessment. Students were given a choice of problems to work on and had to make slides and record themselves narrating how to tackle a problem. The lecturer assessed the presentations for understanding and presentational qualities. Marks were also given for participate in a peer-review activity. This presentation will discuss the design of the assessment and practical issues encountered.

Issues surrounding individual programming tests on large modules

James Grant, University of Lancaster

I'm going to speak about my experiences of designing programming assessment in the context of an introductory Statistical Learning module with a broad curriculum and large diverse cohort. In particular, I will reflect on the challenges of simultaneously assessing several different topics, while choosing a design that can be produced and marked efficiently but that discourages collusion.

Online electronic assessment in a large undergraduate statistics module

Alena Haddley, University of Liverpool

I would like to present how I use online electronic assessment in the large second year undergraduate statistics module (500 students), using the platform Möbius courseware. The assessment is in the form of online class tests where each student has different randomly generated data. For some questions students need to analyse data using the statistical software R. The assessment is marked automatically by Möbius, providing individualised response specific feedback, enabling all students to receive prompt, good quality feedback. The assessment is designed using a scaffolding approach, helping students to learn statistical methods and interpret results.

Peer assessment via comparative judgement

David Sirl, University of Nottingham

For the last few years I have had as a component of assessment in a 2nd year probability module an exercise where student responses to an open-ended problem are peer-assessed using a comparative judgement procedure. This involves students comparing pairs of responses and choosing which demonstrates the better mathematical understanding. This data is then fed into a statistical model (the Bradley-Terry model) which outputs scores which represent the relative "quality" of each response, and these are checked/moderated to ensure fairness/reasonableness. I'd like to provoke discussion on the pros and cons of this method of peer assessment, and how it compares to others.
