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Special issue editorial: Restarting the New Normal

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We are delighted to present this special issue of Teaching Mathematics and its Applications with the title “Restarting the New Normal”. The title itself is an oxymoron since at the time of conception it was far from clear whether mathematics teaching would be restarting as before after a significant interruption or transforming to a new normal. The brief of this issue was to consider papers on research in one or more of the following areas: approaches to teaching post-16 mathematics to students during COVID-19 restrictions, the needs of mathematics learners in COVID-19 affected cohorts and general distance learning of mathematics.

Three guest editors, supported and led by an existing editor, began work on the special edition in September 2020. Through this edition we aimed to encourage research and reflection that directly informs future practice. We are appreciative of the effort of the authors, particularly because the papers were written at a time when we were all still affected by the impact of COVID-19.

Teaching during 2020 and 2021 involved quick professional development and learning for staff and students, even for the most technically competent amongst us. Many were suddenly teaching or supporting students in an environment we were not used to or prepared for. Internationally, there were numerous collaborative events, such as Teaching and Learning Mathematics Online (<http://talmo.uk/>), which allowed for dialogue between innovators and those with existing experience of distance learning provision. Never before has there been a significant shift in such a short period of time within the teaching of post-16 mathematics.

The early stages of COVID-19 caused the closure of school, college and university campuses globally and led to an urgent requirement to instigate alternative ways of learning and teaching. The term ‘emergency remote teaching’ is often used to cover this initial response. Several of the authors in this special edition point to Hodges *et al.* (2020) who summarise emergency

remote teaching as ‘*a temporary shift of instructional delivery to an alternative delivery mode due to crisis circumstances*’ that contrasts with ‘*experiences that are planned from the beginning and designed to be online*’. Remarkably, given the circumstances of that period, practitioners quickly started to investigate and evaluate these initial responses.

As it became apparent that online or remote teaching would continue in the latter parts of 2020 and beyond, the benefit of moving quickly to collate relevant research on best practices was clear. As a result, there are three types of paper within this issue – those focussed on the sudden shift which required instant changes to teaching practice, those considering more established approaches (including from the Open University who already taught online) and those which study iterations aiming to improve an initial design.

The first call for this Special Issue was in May 2020 and submissions were due in February 2021. Within a short window for submissions, there is naturally less time for planning and implementing research. However, the editors and reviewers were satisfied that the researchers have collected and analysed data to evidence the different effects of COVID-19 that they were investigating. In most cases, studies were undertaken at one institution, with the data analysed ranging from surveys and interviews to measures of student engagement and attainment. Covariables such as gender and ethnicity are also studied. A notable feature of the editing process for this special issue has been the collective refinement of claims and arguments. Reviewers and authors proved open to critiquing the relevance and generalisability of the results with reference to developing teaching practices and issues of professional and intellectual significance.

Time is a premium for everyone, especially during the pandemic, with colleagues juggling several commitments and high workloads. We were impressed in having received exceptional papers, in such exceptional times, and in the quality of reviews. We enjoyed reading and looking after them during all the stages of the publication process. We hope you acknowledge, as we do, that these papers have captured incredible efforts that were made by teaching staff and students to provide an enriching learning environment. At time of writing, September 2021, it is clear that the papers not only offer the opportunity to look back at a unique and memorable time in history, but start a process of recording the deliberations that underpin how we will navigate new teaching considerations and circumstances in mathematics.

Despite many difficulties within the COVID-19 pandemic, there may be some positive consequences. Initial research suggests that young people are now more interested in science careers as a result of COVID-19 (British Science Association, 2020), and one may assume that this could translate to additional students of mathematics in the near future. As we identify below, positive aspects can be seen within this special edition, several of which would have possibly remained unknown if it had not been for the pandemic.

Before briefly describing the contents of the special issue, we make the following remarks, which should be kept in mind, since they may add context to the work described within:

- Different countries were, and are, operating under different COVID-19 circumstances and restrictions at any given point in time.

- Universities do not have the same timings in the academic year, and our colleagues in countries such as Australia were only part way into their academic year when they were first affected by COVID-19.
- There is no one-size-fits-all approach to adjusting education in the time of a pandemic. Adjustments made are likely to be influenced by several factors, including staff expertise and the equipment available to them, the rules and regulations bestowed upon staff by their employer and government, and the make-up of the student cohort.

The papers within this issue broadly concern topics such as school and university transitions, mathematics support, and mapping the effect of changing the medium of provision. These headings are not exhaustive, and indeed it can be argued that several of the included papers fall under more than one of these classifications. The descriptions that follow are not an attempt to summarise the papers, but give an indication of how we classified them into each topic.

School and university transitions

The paper by Hodds compares the entry competences of students arriving at a UK university in October 2020 with those who entered in previous years, by use of a common diagnostic test. Despite this paper offering some positive news, its results are in contrast with those of Golding who did note a decrease in mathematical preparedness, a profound impact upon the learning experience of the 16-18 year old advanced mathematics student and a stark decline in their confidence. While these papers address mathematical preparedness within the curriculum, Lyakhova et al. point out the effect of COVID-19 on mathematics outreach events and report on student engagement with video materials offered to 16-18 year olds in Wales. The two papers focussing on school-age students both warn of disparate experiences, with a few students adapting successfully to a combination of asynchronous resources and interactive support while many struggled to learn mathematics at a distance despite their familiarity with technology in other guises. Papers in this section also raise questions about the purpose and effectiveness of current school-leaving examinations.

Mathematics support

The paper by Gilbert et al. talks of the adjustments made to mathematics and statistics support services, describing results of a questionnaire distributed internationally early in the pandemic and follow-up interviews with practitioners seven months later. They acknowledge some merits of support provision taking place online, but envisage that face-to-face support will return as the dominant mode of provision when circumstances allow. Crowley et al.'s evaluation of online mathematics support argues that such provision will become increasingly important and valuable in the future. Analysis of student interactions with their online mathematics support materials showed high engagement levels, but there could be some confounding variables partially explaining this success. Mullen et al. compare student and tutor perspectives on mathematics support in two institutions, one in Ireland and the second in Australia. Responses in interviews mainly revolved around five key common themes. Finally, Mac an Bhaird et al. reflect on undergraduate experiences of online study groups and drop-in mathematics support, describing

what they felt to be the positive and negative aspects of the online provision. The study groups were a new initiative as a reaction to low student engagement with drop-in sessions. The findings are used by the authors to suggest modes of future support.

Mapping the effect of changing the medium of provision

Technology has a key role in underpinning the adjustments made to the delivery of teaching. Hilliam et al. offer their experiences from the Open University, who are well versed in online and distance learning. They summarise and evaluate their attempts before the pandemic to improve consistency of academic and pastoral support for all of their students. This paper discusses some issues and solutions that other practitioners are likely to meet as they develop their online provision.

Several papers focus on the early pedagogic issues and solutions trialled by mathematics lecturers, both in the emergency phase and as practice settled. Ní Fhloinn and Fitzmaurice describe the results of an international survey asking practitioners what hardware and software they have used, and what training and support was made available to them. They also tried to understand the rationale of the choices made by those surveyed regarding the live and pre-recorded lectures. Lishchynska et al. compare face-to-face small-group tutorial delivery with a virtual alternative. Key issues were described and factors to consider when developing future remote delivery are offered. Finally, Kempen and Liebendörfer investigated students' reported use of a variety of teaching resources in a newly-online linear algebra course in Germany. They offered the valuable comment, easily forgotten, that enabling social contact between students is important.

The impact of COVID-19 teaching on students should be considered over different timescales. Focussing on the immediate impact, Hyland and O'Shea research student perspectives on COVID-19 closures at Irish universities. The surveyed students also describe how they would like teaching to be delivered in the future. Büchele et al. examine measures of student participation, predictors of performance and student malpractice, comparing 2020 with two previous years. They identify an emerging gender gap negatively affecting women and comment on the effectiveness of their provision. Shaw and Tranter conduct a statistical analysis of awarding gaps in the student cohort, before and after an early period of lockdown. They provide evidence to suggest that the awarding gap for students with a lower-socioeconomic background had worsened, but the gap for Black and Minority Ethnic students had reduced.

Closing remarks

This special issue represents a snap-shot of the research conducted into the impact of COVID-19 upon post-16 mathematics education. We anticipate further innovations, continued evaluation and consideration of best practice, particularly as COVID-19 may have to be tolerated indefinitely (Kissler *et al.*, 2020).

As we exit the pandemic hopefully and learn to live with COVID-19 as an endemic virus, it will be interesting to see which of our new practices remain, and which return to as they were. We hope that the papers in this special issue, which have evaluated the relative merits and disadvantages of doing things differently, will help inform this dialogue.

The fact that the global pandemic is still very much on-going weighs heavily on all of us. We are keen to pay tribute to all students and staff working in education for rapidly adapting to the extreme circumstances that we have operated under, balancing the significant challenges of trying to live normally in a world that is currently anything but normal. A silver lining of the COVID-19 pandemic was the start of significant reflections on teaching practice in the discipline on a scale unseen before. It is safe to say post-16 mathematics education will not be the same again.

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Jonathan is Reader in Statistics at the School of Mathematics at Cardiff University. He is an Editorial Board member of MSOR Connections. Jonathan is currently interested in the statistical analysis of the National Student Survey and the Teaching Excellence Framework. In the past he has published on the effective delivery of mathematics support services, diagnostic testing and new methods for giving student feedback.

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