

The Impact of Covid-19 on Mathematics Education

Thomas Hobson MIMA, University of Lincoln and ECM Committee Member

The Covid-19 pandemic led to the disruption of teaching and learning systems globally. In the UK, educational institutions across the sector needed to adapt to facilitate learning remotely during national lockdowns whilst supporting students face-to-face in order to maintain essential services. Even when restrictions were eased, the need for social distancing, regular testing and isolation meant that returning to pre-pandemic strategies was not an option for many institutions. Despite the challenges the pandemic presented, a silver lining can be taken from the lessons learned and the innovations made. The pandemic led to a reimagining of what education could, and should, look like in the 21st century.

To get a broader view of the challenges and innovations of the pandemic, I interviewed three members of the education community. First, Belinda Brown is a lecturer at a large further education college in the north of England, where maths is taught to 16–18 year olds (often in addition to a main vocational programme), apprentices and mature students. Second, Dr Zoe Nye is a senior lecturer in mathematics education at Bishop Grosseteste University in Lincoln and is a lead evaluator of the maths hubs run by the National Centre for Excellence in the Teaching of Mathematics. Finally, Jack Worth is a lead economist from the National Foundation for Educational Research who investigates how to improve teacher recruitment, retention and development.

How have students fared?

Being a core subject, the teaching and learning of mathematics takes place across the education sector, either explicitly in maths sessions or in support of other discipline areas, both academic and vocational. Therefore, the effect of the pandemic on maths education is likely to be widespread and complex. Ofqual, the body that regulates qualifications, examinations and assessments in England, reports that learning losses in mathematics appear to be more prevalent than in other core subject areas, such as literacy [1]. This is attributed to mathematical skills being more challenging to develop outside of a school setting.

The Joint Mathematical Council of the UK (JMC) and the Royal Society Advisory Committee on Mathematics Education (RS ACME) suggest that more than half of students are more than three months behind in their maths learning [2]. Belinda Brown says these gaps in knowledge can be seen in the students that join her institution; students are entering the setting having not been introduced to some topics and therefore teaching has had to start at a lower pitch than in previous years. The JMC and RS ACME report that more than half of teachers surveyed have had to change what they teach in response to the pandemic [2].

But prior subject knowledge is not all there is to the classroom. A student's emotional response to a subject has a substantial impact on their learning. The JMC and RS ACME report that the pandemic negatively impacted students' motivation, suggesting it had a greater impact on learning than a lack of access to digital technologies [2]. This is echoed by Belinda Brown, who spoke about how her colleagues have experienced engagement issues in their cohorts at a greater level than before the pandemic. The same is true in my practice; students who entered my higher

education setting during the pandemic found themselves, in their own words, running out of motivation, citing the lack of social interaction and isolation as the primary cause.

Yet the post-lockdown academic year has not fared much better. Although some students have bounced back, a lot are still struggling to motivate themselves, with fewer students participating in the social activities that we know promote student well-being and engagement. But it is not just maths that is seeing this. The *Chronicle of Higher Education* reported that professors from a variety of disciplines were seeing struggles with student engagement as a result of the pandemic [3]. Professors found that students were struggling with the demands of education and that institutions were finding that student anxiety had risen significantly in the latter part of 2021.

How have teachers responded to the pandemic?

The pandemic has not only impacted students, but teachers, academics and support staff as well. Covid-19 infection and isolation has brought about a period of high staff and student absence, which the JMC and RS ACME suggests is likely to cause further negative impacts [2]. A survey by NASUWT – the teachers' union – found that 84% of teachers felt that staff absences were having an impact in their setting and that many teachers were required to cover for absent colleagues [4]. The JMC and RS ACME also report that teachers are leaving the profession, due to feeling undervalued and under-resourced [2].

Mathematicians often develop a range of digital skills either through explicit study or through the transferability of mathematical skills to technological ones. With these skills, maths specialists are often well equipped to support others when it comes to digital technologies. Dr Nye suggested that when schools closed and online learning began, maths teachers were often on the front line of supporting colleagues to develop the skills necessary to continue learning remotely. This added pressure to already stretched teachers who provided support not only for the learning in their discipline but also the other disciplines taught by their setting.

How has teacher training changed?

Maths has struggled to recruit teachers in recent years. For example, the 2019 applications fell well below the target. However, during the pandemic, applications rose significantly, almost to target levels. Dr Nye attributed this to the perceived security of the teaching profession. She explained how during times of financial crisis, such as recessions, applications for teacher training increase as the workforce seeks stability. She also discussed how those that home-schooled children found themselves enjoying teaching and wishing to follow it up as a profession.

Figure 1 shows a graph, produced by Jack Worth, showing the number of placed initial teacher training (ITT) applicants throughout the pandemic [5]. This year the number of placed ITT applicants appears to be on track to reach target levels, despite a lowering of acceptance rates across all subject areas. However,

Jack explains that this has mostly been as a result of the Department for Education lowering target numbers from 2800 in 2021 to 2040 in 2022. Dr Nye spoke about how mathematics graduates are in high demand and were being enticed to other careers, describing it as a ‘bunfight’ for graduates.

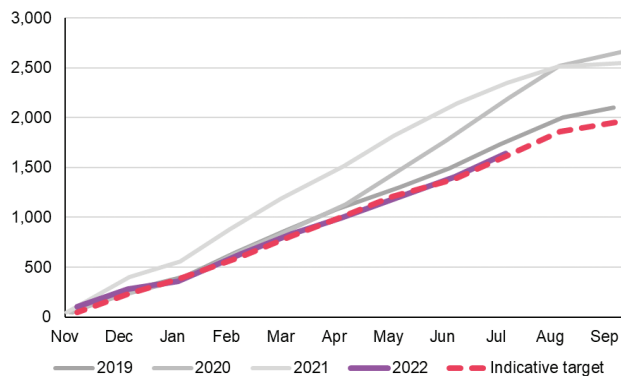


Figure 1: Total number of placed initial teacher training applications for maths teachers in England (from [5]).

Dr Nye suggests that new trainees have been less well prepared for the rigour of the classroom and have commenced training with lower resilience than previous cohorts. Many trainee teachers are recent graduates; therefore, their own educational experience has been impacted by the pandemic. It is reasonable to assume that they themselves have experienced some of the anxiety and engagement struggles that other students have faced. Dr Nye shared how recent trainees have needed more support than previous cohorts and have struggled with confidence after the isolation of lockdowns. Additionally, the lack of face-to-face impromptu conversations has meant that identifying students needing support has become more challenging for academics since the pandemic.

The restrictions imposed during the pandemic meant that settings needed to adapt their practices to continue to facilitate learning. With every setting catering to a different demographic, the approach taken varied substantially. This meant that ITT looked different for each trainee. For some trainee teachers, their experience was primarily made up of delivering online sessions, whereas in other settings, remote education was left to more experienced practitioners and trainees taught the limited number of students who could attend in person.

Before the pandemic, Dr Nye would often know the structure of each trainee’s experience, as most settings would approach ITT in a similar way. However, throughout the pandemic, each trainee’s experience was more unpredictable. Some trainees had developed a greater awareness of how to provide quality teaching online yet had little experience of the classroom environment. In contrast, others had experienced the traditional classroom setting without being exposed to teaching remotely online.

But what about the positives?

It would be easy to simply report the many negative impacts that the pandemic has had, but what good has come from it? As we transition into a ‘living with Covid’ strategy, we see many aspects of our lives returning to pre-pandemic practices in a bid to return to ‘normal’. Yet Dr Snezana Lawrence, the diversity champion for the IMA, made a poignant remark at the April Diversity Event: ‘Normal wasn’t that great for some people’ [6]. The pandemic has helped highlight inequalities but also shown that some of these can be improved with the techniques we utilised during lockdowns.

Belinda Brown discussed how in her setting some online, distance provision has been retained. Speaking about adult learners, a demographic more likely to be under-represented, she discussed how an online alternative to her GCSE provision has allowed more students the opportunity to access education. Mature learners often have responsibilities outside of education, such as work and childcare, which impede their ability to access education. Providers have for a long time offered evening and weekend classes, but as Belinda Brown says, for adult learners ‘life sometimes gets in the way’ and the opportunity to access a session online allows these students to juggle life and study.

Distance learning delivery has required the development and sharing of online learning resources, another positive legacy of the pandemic. Belinda Brown discussed how a wealth of online learning resources have been made available from both exam boards and other practitioners. Dr Lawrence summed this up as the sector moving into a new paradigm of ‘co-operation rather than competition’ [6].

The next iteration of teachers will also be accustomed to this new style of teaching. Many teachers have had experience of teaching online as a result of the pandemic. Dr Nye discussed how the ITT curriculum has evolved to prepare teachers to use online tools. She spoke about how digital technologies were included in training pre-Covid, but after witnessing how vital these have become, new teachers are introduced to more of these, with some example sessions being delivered online themselves.

In addition, using digital technologies may not only support students learning from a distance but actually close gaps in learning. A study by the LEARN! Research Institute in Amsterdam found that using adaptive practice software for maths, which gives students different learning activities based on the result of assessments, mitigated the impact of school closures [7]. In fact, it was found that using this type of digital technology may even reverse the negative effects of school closures, demonstrating how online learning resources have the potential both to support future learners and also to recover the learning losses students have experienced over the pandemic.



Online learning became the norm.

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A new normal

Although the pandemic has promoted innovation and redevelopment, it has also brought about many challenges. The aim for the sector must now be to identify these and work towards resolutions, whilst being wary of falling into old practices that disadvantaged some demographics. The JMC and RS ACME have highlighted the need to continue to monitor the impact of the pandemic through collecting quality data within timeframes that facilitate the informing of guidance for further interventions [2].

Belinda Brown suggested that some of the focus must be on rebuilding the social skills of students that are underdeveloped due to the prolonged periods in isolation. This is echoed by Dr Nye, who saw the detrimental effect isolation had on trainee teachers, who could often be the only ones left in their accommodation during a lockdown. In my setting, the student representatives believe that developing these social skills (specifically, working collaboratively with new people, being confident in an unfamiliar setting and building friendships) will help support the student body to engage with their studies. They are now working with academics and support staff to formulate events and activities that directly address the acquisition of these skills.

Ofqual has highlighted the learning losses experienced by students through the pandemic [1]. The government aims to combat this with the National Tutoring Programme and a catch-up premium for schools. In addition, students sitting their GCSE and A-level exams were given advance information about their upcoming exams. Belinda Brown explained how this prior information alleviated students' anxieties about their upcoming exams and has been a vital stepping stone in returning back to face-to-face exams; however, she acknowledges this may have contributed to the continued grade inflation seen this year [8].



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Celebrating the first exam results since the pandemic.

Conclusion

The global pandemic has had a serious and lasting impact on most of the planet and the education sector has not been left unscathed. For some students, the pandemic has resulted in learning losses and knowledge gaps, particularly in mathematics. But it is arguably the effect on the students' mental well-being that will have the greatest effect on their learning. Despite initial uplifts in teacher training applications for mathematics, the teaching workforce has suffered with many teachers ill and some leaving the profession.

However, the pandemic has presented opportunities for reflection, innovation and enhancement. The use of online learning opens the door for more students to access education. Digital technologies have the potential to support students, with new teachers being introduced to more of these as a matter of course.

The pandemic has cast a grey cloud over education, and although it does not look sunny just yet, there may still be a silver lining after all.

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Returning to exam assessments.

The gaps in knowledge observed by practitioners and the potential inflation of grades suggest that educational institutions need to consider whether their curriculums need to adapt to ensure that underpinning knowledge, often vital in mathematics, is present before offering new learning. In addition, providers need to be mindful of the anxiety that exams may present to those who have not experienced them as a result of the pandemic and should consider what support can be put in place to build up student confidence, for example through exposure to low-stakes exam-style assessments.