Teacher engagement with online professional development – A case study of a 'Core Maths Festival'.

Stephen Lee[1], Tom Rainbow[1], Catherine Van Saarloos[1], Rebecca Landon[2] and Charlie Stripp[1]

[1]Mathematics in Education and Industry, [2]Tribal

The government-funded Advanced Mathematics Support Programme (AMSP) seeks to improve the quality of 11- 19 mathematics teaching. One way it does this is by providing extensive professional development (PD) for teachers. As part of its response to the loss of face-to-face PD for most of 2020 due to COVID-19, the AMSP developed an online 'Core Maths Festival' (CMF), which ran from May to July 2020. The CMF consisted of 22 online PD sessions. It was promoted through the AMSP's extensive networks and 3622 participants registered to attend one or more sessions, including 1177 distinct teachers from 794 distinct state schools and colleges. This paper uses the CMF as a case study to explore teacher engagement with online PD. It gives background to Core Maths qualifications, and why such PD is needed. It also considers the uptake of Core Maths in the attendees' schools and colleges, and reviews feedback from over 850 participants.

Keywords: Core Maths; post-16 mathematics; curriculum; professional development.

Background to Core Maths qualifications and the Advanced Mathematics Support Programme

Core Maths qualifications are still relatively new. They are post-16 level 3 qualifications in England and were first examined in 2016. An expert panel, Advisory Committee on Mathematics Education (ACME. 2013), offered recommendations for the qualifications' characteristics in October 2013 and the Department for Education (DfE) issued a policy statement approving the development of the qualifications in December 2013, (DfE, (2013), with the aim that Core Maths will contribute to addressing the problem of poor take up and progression in post-16 maths education. Curriculum development work, led by Mathematics in Education and Industry (MEI), that informed the development of the Awarding Organisations' final exam specifications is discussed in Dawson and Lee (2015) and Dawson et al., (2016).

Core Maths qualifications are designed specifically to enable students to develop the quantitative skills they need to use maths and statistics with confidence in real life contexts. They have the same guided learning hours and UCAS tariff points as an AS level. They can be studied over one or two years, can be taken alongside A levels or other level 3 qualifications and are graded A-E. Full details of a current specification can is available from the Assessment and Qualifications Alliance (AQA, 2020).

The first Core Maths examinations took place in 2016 with 2931 candidates (from approximately 200 schools and colleges). Numbers have increased each year since; 5376 in 2017, 6649 in 2018, 9027 in 2019 and 11792 in 2020 (MEI, 2020), and the number of schools and colleges offering Core Maths has more than trebled.

Core Maths numbers are increasing rapidly, but there is a long way to go (the potential annual cohort is over 200k). Homer et al., (2020, p. 3) found "Core Maths

courses are valued by teachers and students who have experienced them", but the current funding model presents a major barrier:

> The nature of Core Maths, designed to sit alongside main programmes, does not easily fit into the new per-student funding regime. Institutions struggle to find attractive and cost-effective ways of including Core Maths in their curriculum provision. In addition, the continuing lack of recognition of the qualification by higher education and employers limits its appeal to students.

These barriers must be overcome if Core Maths is to raise post-16 level 3 maths participation as the DfE policy intends.

Government support for Core Maths

In March 2016, the Government announced that an external review into post-16 mathematics would be undertaken by Professor Sir Adrian Smith. Recommendation 1 of the final report (Smith, 2017, p. 7) states that all schools and colleges should be able to offer core maths:

> Recommendation 1: The Department for Education should seek to ensure that schools and colleges are able to offer all students on academic routes and potentially students on other level 3 programmes access to a core maths qualification.

Recommendation 9 (Smith, 2017, p. 11) states that there should be a centrally funded support programme for core maths:

> Recommendation 9: The Department for Education should continue to fund a central core maths programme until the qualification becomes embedded and enhance this to upskill large numbers of teachers of other quantitative subjects to teach core maths.

In 2018 MEI was successful in an open tender for a new Advanced Mathematics Support Programme (AMSP), which builds on from the national Further Mathematics Support Programme (Lord & Lee, 2016) to include support for Core Maths. This accorded with other recommendations from the Smith Report, e.g. recommendation 10, that the DfE "…should continue to fund centrally-delivered professional development programmes for teachers of AS/A level Mathematics and Further Mathematics…" (Smith, 2017, p. 11).

Teacher professional development

A key finding from the Developing Great Teaching review (Cordingley et al., 2015) was that subject-specific professional development (PD) is more effective than generic pedagogic PD (in terms of its impact on pupil outcomes). Subsequently, the Wellcome Trust (2018, p. 3) highlighted that "changes in curriculum and assessment policies are key drivers of demand for subject-specific PD". Core Maths is a new qualification so there is a clear need for subject-specific PD to support its teaching.

School closures due to COVID-19 and changes to AMSP provision

Schools and colleges in England were closed to most pupils on 20th March 2020 in response to the COVID-19 pandemic. Online learning was facilitated where possible. From 15th June, secondary students in Years 10 and 12 returned for some face-to-face study. Schools and colleges were fully re-opened in September 2020.

The AMSP had a flexible and balanced PD offer in place pre-COVID-19. This was extensive and varied in both the style and content, including short face-to-face

sessions such as hosting teacher network meetings, live fully online courses over several weeks, asynchronous 'on-demand' online courses, and extended 'sustained' courses that blend face-to-face and online components over a 12-month period. DfE funding allows the AMSP's PD offer to be provided to teachers in state-funded schools and colleges at zero or very low cost.

The disruption to education caused by COVID-19 meant that, between March and September 2020, all face-to-face AMSP PD events had to be postponed or cancelled. To maintain its support for teachers, the AMSP moved its summer term PD provision online, developing additional and alternative PD courses. As part of this adapted provision the AMSP developed the Core Maths Festival (CMF), an innovative online Core Maths PD programme.

Core Maths Festival – a case study

The CMF consisted of 22 online sessions, hosted via Zoom from May to July 2020. Each week there were two 90-minute sessions, usually on Tuesdays (11:00-12.30) and Thursdays (14:00-15:30), i.e. during the normal school day. A small number of sessions were on different days/times, and the final session was 180 minutes.

Session content covered all aspects of Core Maths teaching, including use of technology to facilitate teaching and enrichment activities to motivate student interest. Session design sought to engage participating teachers by using various delivery techniques such as breakout rooms for discussion, screen sharing of software and using external online tools such as Desmos, which allows engagement with mathematics materials and interactive 'tasks'.

Titles of sessions included: Getting started with Core Maths; challenging topics in Core Maths; teaching financial maths; my first two years with Core Maths; interpreting graphs to unlock curiosity; designing Core Maths tasks using real data; teaching maths in context; the importance of mathematical modelling; teaching confidence intervals with confidence, and critical statistics: Core Maths and Social Sciences.

Engagement with the CMF

Analysis of engagement with the CMF was undertaken after the programme had ended. This included teacher sign-up to the CMF against attendance/non-attendance, institutions' recent entries to Core Maths qualifications, and the number of different sessions attended (by distinct teachers and distinct institutions). Note: All analysis in this paper concerns teachers in state-funded schools and colleges. The CMF also had some participation from independent schools, overseas teachers, and university staff/student teachers (this was possible because the online delivery meant space/capacity was not limited).

A total of 1177 distinct teachers, from 794 distinct state schools and colleges, signed-up for the CMF. Of these, 926 distinct teachers from 575 distinct schools and colleges attended the CMF and 251 distinct teachers from 219 distinct schools and colleges did not attend. So, approximately one in five teachers, from one in four of the schools and colleges that signed up, did not attend.

A school's or college's current/previous uptake of Core Maths was explored using DfE census data. For those with at least one attending teacher, approximately half of the schools and colleges had Core Maths entries in at least one of the past four years (51.1%). This proportion was lower in schools and colleges that signed-up for the CMF but whose teachers did not attend (42.9%). In around half the schools and colleges of

teachers who attended the CMF there was no current Core Maths provision, nor any in the last four years. This means a good balance of experienced teachers of Core Maths and teachers new to Core Maths took part in the CMF.

Across all sessions there were 3622 participants, with 926 distinct teachers, indicating each teacher attended four sessions on average, i.e. six hours of Core Maths PD, assuming they engaged with the whole of each session. More detailed analysis showed the modal number of sessions attended was one (359 distinct teachers), followed by two sessions (165 distinct teachers) followed by three (91 distinct teachers). However, seven attended 21 sessions (over 30 hours of Core Maths PD, assuming they engaged with the whole of each session) and three teachers attended all 22 sessions!

The 926 distinct teachers who attended the CMF came from 575 distinct schools and colleges. The modal number of distinct attending teachers from a school or college was one (384 distinct schools and colleges), followed by two (105 distinct schools and colleges) followed by three (50 distinct schools and colleges). Two schools and colleges had nine teachers who attended the CMF and three schools and colleges had seven teachers who attended the CMF. Therefore, although most of the schools and colleges involved (66%) had one teacher attend the CMF, a third of schools and colleges had two or more teachers attend the CMF. Having more than one teacher attend suggests particularly strong interest in and commitment to Core Maths from the schools and colleges concerned.

Feedback from the CMF

Feedback was sought in the first eight CMF sessions, i.e. those that took place in May 2020. A total of 877 responses were received, this represented a 68% response rate. For the overall rating, 64% gave a rating of 'Excellent', 33% 'Good' and only 3% 'Adequate' (with 0% rating 'Poor'). There were 873 comments received within the feedback. These have been categorized into five main themes in Table 1, with examples of comments received.

Table 1: Themes seen within the feedback from CMF sessions

Theme of feedback	Example of feedback received
Many teachers hadn't taught Core Maths, but attendance helped them to consolidate their intentions	Not yet teaching Core Maths, only just part of discussions in school. Possibly in 2021/22. After this session I am convinced that we will have to introduce Core Maths.
Those who were at both ends of the experience scale with teaching Core Maths found benefit	I really liked the session. I am very new to Core Maths, my school has taught it for past 2 years but I thought I would use the lockdown time to improve my own understanding PD. I was really pleased with the structure of the session and the Desmos was amazing and worked really well. Fab - I've been teaching Core Maths since the pilot and I still learn something new every time!
The CMF was engaging and inspiring as a piece of PD	As I expected, this was a superbly entertaining, inspiring and useful session. Highly interactive - which in the current climate was really welcome.
The PD received has direct application to classroom teaching	Excellent to take a reliable source of data from ONS and convert it into lesson material. Really great ideas pulled out

	which I will put not only into Core Maths teaching but hopefully lower down school as well! Interesting, good ideas for class, motivation and good morale boost at the moment. It was needed. Thank you
The quality, availability, cost and timeliness (during a pandemic) was widely acknowledged	Another completely inspiring session - can't tell you how much I'm loving these - I'd never have been able to come along if it was 'in the flesh' as I don't currently teach Core Maths, but this has really helped and given me loads to think about. Thank you!

Observations and concluding remarks

Analysis of engagement levels and feedback from the CMF suggests providing online PD for Core Maths across England during the pandemic was successful.

The experience of creating, organising and reviewing the CMF has provided some useful insights, including:

- A coherent set of 'pick and mix' PD sessions around one area (in this case Core Maths) can be a powerful PD offer that benefits both experienced teachers of a topic or course and those new to teaching it.
- Specific sessions on technical aspects of a qualification, sessions addressing general teaching and learning insights, and more 'enrichment' orientated sessions all have a place in a comprehensive PD programme.
- PD can and should be engaging and inspiring, whether online or face-to-face. Important features include: interactivity, breakout discussion groups for participants, engaging and knowledgeable session leaders, and using technology in interesting and innovative ways.

More widely, with respect to teacher engagement with online PD:

- The ease and accessibility of online access can allow large numbers to attend, including many who could not or would not attend face-to-face PD.
- Particularly if an event is free, there may be a high proportion who don't attend after signing up [for the CMF this proportion was 21%].
- Drop-out after original sign-up may have been exacerbated by the pandemic and lockdown situation, i.e. more teachers signed-up to more online events, but then could not attend them all.

Concluding remarks

Three overarching conclusions from this case study of a large-scale PD intervention (over 900 teachers from more than 600 schools and colleges) are:

- Subject specific online PD for maths is wanted and valued.
- PD that allows for direct application to a participant's classroom teaching is seen as especially desirable.
- Core Maths is a qualification that excites teachers; they want to be able to offer Core Maths to students in their schools and colleges.

The necessity to move to online PD in response to the COVID-19 pandemic may have provided impetus to accelerate the 'transformational potential' of online PD to help grow the number of effective teachers, as described by Smith (2017, p. 76):

> Classroom tools have a role to play in supporting teaching, but the transformational potential for technology lies in helping grow the number of effective teachers through online professional development…

It does not necessarily follow that post-pandemic uptake of online PD will be as large but, following their successful engagement with online PD during the pandemic, it seems likely that more teachers will be receptive to engaging with online PD. The AMSP is planning an extensive online PD offer in 2021 and beyond.

Finally, the CMF was aimed directly at raising awareness of the relatively new Core Maths qualifications, and upskilling teachers to teach Core Maths through online PD. Glaister (2017,p. 1) asserted that "Core Maths is the most significant development in post-16 mathematics in a generation". The success of the CMF has highlighted teachers' appetite for Core Maths and demonstrated that online PD can play a key role in establishing Core Maths in our schools and colleges.

References

ACME. (2013). *Report from the expert panel on core mathematics.* Advisory Committee on Mathematics Education.

AQA. (2020). *Level 3 Mathematical Studies.* https://filestore.aqa.org.uk/resources/mathematics/specifications/AQA-1350-SP-2014.PDF

Cordingley, P., Higgins, S., Greany, T., Buckler, N., Coles-Jordan, D., Crisp, B., Saunders, L. & Coe, R. (2015). *Developing great teaching: Lessons from the international reviews into effective professional development.* Teacher Development Trust.

Dawson, T. & Lee, S. (2015). Developing an innovative curriculum and teacher pedagogy for nurturing a positive disposition towards learning and using mathematics in post 16 students in England – 'Critical Maths'. *Proceedings of IMA International Conference on Barriers and Enablers to Learning Maths*.

Dawson, T., Lee, S., & Dudzic, S. (2016). Developing new quantitative reasoning and quantitative problem solving qualifications with post 16 students. *Proceedings of the 13th International Congress on Mathematical Education.* https://mei.org.uk/files/pdf/TSG23_PA_dawson.pdf

Department for Education. (2013). *Introduction of 16 to 18 core maths qualifications: Policy Statement.* (DFE-00285-2013). Her Majesty's Stationary Office.

Glaister, P. (2017). *Core Maths: the most significant development in post-16 mathematics education in a generation.* STEM Learning.

Homer, M., Mathieson, R., Tasara, I. & Banner, I. (2020). *The early take-up of Core Maths: successes and challenges.* Nuffield Foundation.

Lord, K. & Lee, S. (2016). MEI Insights VI: The Further Mathematics Support Programme. *Mathematics in School*, *45*(3), 9-11.

MEI. (2020). *Summary of core maths entries and results.* https://mei.org.uk/files/pdf/Summary-of-Core-Maths-entries-and-results-2020.pdf

Smith, A. (2017). *Report of Professor Sir Adrian Smith's review of post-16 mathematics*. Her Majesty's Stationary Office.

Wellcome Trust. (2018). *Developing Great Subject Teaching - Rapid Evidence Review of Subject Specific Continuing Professional Development in the UK*. Wellcome Trust.