

## Issues of contingency in teaching for ‘mastery’

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Inspired by the 2015 special issue of *Research in Mathematics Education* – ‘Mathematics teaching: tales of the unexpected’ – this paper relates ideas about contingency to the demands on primary school teachers in England to deliver a new ‘mastery’ National Curriculum. Drawing on an observation of and interview with one newly qualified teacher, Mandy, this paper explores how her ability to enact a ‘mastery approach’ is stifled by both her commitment to the established school routine for lesson planning and her lack of experience. Unexpected events from her lesson are described and related to the concept of contingency as outlined in the special issue and the question is asked: is a well-rehearsed response repertoire necessary for teaching for ‘mastery’?

**Keywords: English primary National Curriculum; mastery; contingency**

### Introduction

This paper reports on data collected as part of a pilot study for my doctoral research. In order to trial my methods, I observed and interviewed a primary school teacher, Mandy, with a view to finding out about her definitions of ‘mastery’ and how ‘mastery’ was incorporated into her mathematics teaching. It became apparent that in moments when the lesson took an unexpected turn (there was a contingent moment), a ‘mastery’ approach was not (yet) second nature to Mandy. In this paper, I explore my hypothesis that a well-rehearsed response repertoire, on which to draw in contingent moments, is essential to teaching for ‘mastery’.

### The 2014 primary National Curriculum and a ‘mastery’ approach to teaching mathematics

The 2014 National Curriculum for English primary schools (DfE, 2013b) was written in response to what ministers perceived to be disappointing performances in international tests and a resulting need to raise standards (DfE, 2012). This aspiration is apparent in the raised expectations of the new mathematics curriculum content, and in the preamble (‘Purpose of Study’) setting out how teaching is to be approached. The ‘Purpose of Study’ sets out three aims, which can be summarised as: (i) pupils gain mathematical fluency and conceptual understanding; (ii) pupils reason mathematically; and (iii) pupils solve problems (DfE, 2013b, p.99). This is followed by a discussion of approaches suitable for different pupils, broadly akin to the ‘mastery learning’ agenda in the USA (Bloom, 1968):

The expectation is that the majority of pupils will move through the programmes of study at broadly the same pace. However, decisions about when to progress should always be based on the security of pupils’ understanding and their readiness to progress to the next stage. *Pupils who grasp concepts rapidly should be challenged through being offered rich and sophisticated problems before any acceleration through new content.* Those who are not sufficiently fluent with

earlier material should consolidate their understanding, including through additional practice, before moving on. (DfE, 2013b, p.99 my emphasis)

This statement represents a significant change in the guidance to schools on how to work with pupils who “grasp concepts rapidly” (DfE, 2013b, p.99). Previously a vertical scale of National Curriculum levels was used both to describe pupil attainment and progress, and as schools (and increasingly, teachers) were judged on pupil performance, some pupils who grasped concepts rapidly were accelerated to work on secondary school content in the later years of their primary education. This practice was encouraged by the existence of a higher level nationally reported test paper but criticised by the Advisory Committee for Mathematics Education (ACME) as encouraging “only a shallow mastery of the subject” and promoting “procedural learning at the expense of deep understanding” (ACME, 2012, p.2).

Although the word ‘mastery’ does not appear in the National Curriculum documentation for mathematics, the word has been widely used by ministers (DfE, 2013a), and the National Centre for Excellence in the Teaching of Mathematics (NCETM, a government funded quango) put the ‘Purpose of Study’ at the heart of what it describes as a south-east Asian style ‘mastery approach’. This can be summarised as: teachers hold and share the belief that all pupils will achieve; task differentiation is by depth not acceleration; lessons foster deep conceptual understanding; practice of procedures is intelligent and builds fluency; and teacher questioning informs prompt interventions (NCETM, 2014). Although few could argue against the merits of the ‘Purpose of Study’ and the ‘mastery approach’ outlined by NCETM, shifting to this new way of working places high demands on teachers’ subject knowledge. Enacting such changes when practices have been developed in line with a previous system (dominated by discourses of ability and accountability) requires a change in mindset and culture which schools are beginning to tackle.

### **Preparation for teaching**

The subject knowledge required for teaching mathematics is theorised in the Knowledge Quartet (KQ) (Rowland, Huckstep, & Thwaites, 2005). The first three facets concerning knowledge possessed by the teacher and the application of this in preparation for teaching are the focus of the majority of teacher education programmes. However, the fourth member of the quartet; contingency:

...concerns classroom events that are almost impossible to plan for. In common-place language it is the ability to ‘think on one’s feet’: it is about *contingent action*. The two constituent components of this category that arise from the data are the readiness to respond to children’s ideas and a consequent preparedness, when appropriate, to deviate from an agenda set out when the lesson was prepared. (Rowland et al., 2005, p.263)

Its inclusion in the KQ is an acknowledgement that classrooms are unpredictable places. As such, teachers are well-advised to prepare for the complex act of teaching and this preparation subsequently provides the backdrop against which an event within the lesson is considered unexpected.

### ***Writing a lesson plan***

For many teachers, preparation involves applying their subject knowledge to the production of a lesson plan which encapsulates the ways in which the lesson has been rehearsed or envisioned. However, despite writing a plan, a teacher still does not know how their lesson will ‘go’ until it actually happens:

In the same way that a person in tune with their environment can predict the weather, yet not know it in advance, the events of a lesson remain uncertain until they occur. (Rowland, Thwaites, & Jared, 2015, p.76)

An unanticipated moment could be welcomed and skilfully incorporated into the lesson or it could be considered deviant from the expected lesson plan and ignored by the teacher. Clark-Wilson and Noss (2015) suggest that most teachers consider such moments to be “negative ... unwelcomed” (2015, p.98). The unpredictability of classrooms can make teachers – especially novices, those with poor subject knowledge or who are teaching a topic for the first time – nervous about delivering particular lessons or subjects.

### ***Developing a response repertoire***

Mason (2015) describes how, unlike a novice, an expert teacher is prepared beyond writing a lesson plan because they have:

...access to a repertoire of pedagogic strategies and didactic tactics informed by a deep appreciation and comprehension of the topic, of pedagogy, of psychology, and of sociology. (Mason, 2015, p.110)

He goes on to describe the importance of this well-rehearsed (and well informed) response repertoire in ensuring that, when unexpected events occur, the actions of the teacher are deliberate (are consciously chosen) and not simply a habitual reaction:

Preparation is done by enriching and developing a repertoire of actions or practices, embedded in personal experiences, that can help bring those actions ‘to mind’. Preparation makes it possible to work at noticing opportunities to act freshly, to participate in a moment of choice, before reactions and habits kick in. (Mason, 2015, p.123)

This “‘knowing-to-act’ in the moment” (Mason, 2015, p.125), or knowing how to respond and not react, when unexpected events occur, is what distinguishes expert teachers from others. Rowland et al. (2015) suggest that unlike expert teachers, novice teachers may particularly struggle to anticipate, respond to or manage contingent moments because they may simply lack experience of what happens in classrooms; they are unlikely to have a well-rehearsed response repertoire.

### **‘Mastery’ in Mandy’s classroom**

I observed Mandy teaching a mathematics lesson in her mixed-age grade 3/4 classroom, and interviewed her afterwards using video extracts as prompts for discussion. As a newly qualified teacher (a novice), Mandy is keen to please the school senior leadership team (SLT), and to achieve the targets set for her so that she can fully qualify. She is grappling with ‘mastery’ alongside colleagues because the school is “really hot on trying to get this mastery”, but her personal target, set by the head teacher, is to meet the needs of higher attainers and consequently this group of learners is at the forefront of her thinking.

Mandy described two ways in which the SLT support staff to enact ‘mastery’. The first is a requirement that weekly mathematics planning reflects the three curriculum aims and is handed in for approval. Mandy describes this requirement as “intense”, but she acknowledges that it is valuable to “see ... what we’re missing. And also I suppose it’s good to reflect, ‘do I need a bit more of this in the plan now?’”. This demand results in Mandy and her colleagues investing a lot of time and thought in creating lesson plans which will gain SLT approval.

The second approach is a set of weekly pupil tests brought in for teachers to use in order to identify gaps in pupil understanding and to inform teaching. The content of these tests – especially the language used and the style of questions included – has become central to how Mandy defines ‘mastery’ and is integral to her teaching. She describes how, in her lessons, she has begun to be much more explicit about teaching vocabulary in order to prepare the pupils for these tests. For example, in relation to ‘numerals’:

The reason why I use it is because in the test they use the word ‘numerals’ and then they get confused with when they see ‘numerals’ they’re thinking of Roman numerals and I think, ‘no, it’s only if you’ve got the word Roman in front of it that you need to think about Roman numerals’.

The questions that appear in the tests are often “missing number problems where they have to rearrange the number sentence to get the answer”, and Mandy explained that she now includes these more in her teaching. In the interview, she modelled how a question could be reworked in order to make it more in line with the tests, and with a ‘mastery approach’ requiring pupils to “know the method really inside out ... to find the answer” or “think outside the box” (see Figure 1).

$$73 \times 4 = \boxed{70} \times 4 + \boxed{3} \times 4$$

Figure 1: Transforming  $73 \times 4$  so that it requires pupils to demonstrate ‘mastery’.

### ***An unexpected moment in Mandy’s classroom: teacher insight***

Because of the high status given to lesson plans and the time spent to ensure that they gain the approval of SLT, contingent moments are not welcomed by Mandy. Despite this, there was a contingent moment in the lesson when Mandy had a moment of insight and adjusted her teaching accordingly.

I knew that, in her training year, she had been introduced to the idea of ‘seizing the moment’ in lessons; as recognising the contingent moments that offer an opportunity for improving learning. I introduced the idea that Mandy had ‘seized the moment’ in the introduction to her lesson. Having given the class “half a second” to talk to their partners, she responded to their incredulity by correcting herself and then asking “how many seconds are in half a minute?” Despite my affirmations that her actions exemplified teacher insight – a good thing – Mandy felt that deviating from the plan was not desirable.

### ***An unexpected moment in Mandy’s classroom: unexpected responses from pupils***

In the observed lesson, the higher attaining pupils, having been set off on a problem and encouraged to use their own strategies, deviated from how they were expected to learn; they quickly came to a solution using a different strategy from that which Mandy had anticipated.

Do you know what? I wasn’t what they how they’d worked it out because I hadn’t done it that way myself and I think I was a little bit panicked then because I wanted to show them my way but I should have really, as a good teacher is to listen to what they said but it was that time again, that time factor that I had a limited time with them and then I had to go back with the others ...

In interview, Mandy repeatedly shared concerns about lesson timings and the dilemma of managing groups with different needs and who work at different speeds. In this situation, she was not able to think on her feet in order to explore the methods

used by these pupils or devise a follow up task to deepen their thinking. As she explained:

I mean that's the thing one of my targets is finding how to give that more breadth and depth to higher ability ... I find it difficult. It's just having that bank, isn't it? And maybe I'll use more of the stuff that we see in the test to help, you know what I see and there's things like this (points to sheet of paper, see Figure 1) to help me give them those next steps.

I found it surprising that Mandy described herself as needing a “bank” of ideas because elsewhere in the interview she suggested a whole raft of strategies for supporting pupils (especially the higher attainers) to think more deeply, and also demonstrated an ability to adapt questions in order to provide greater challenge (see Figure 1). However, in this lesson, when the pupils deviated from their expected performance, Mandy gave them a holding activity which did not maintain a ‘mastery approach’ and I speculated that there may be two reasons for this: firstly, was it because the contingent moment was not accounted for on the approved plan, and therefore she didn't have ‘permission’ to be spontaneous; or secondly, was it because whilst she does have great ideas (a response repertoire), she cannot (yet) think of them in the moment under pressure to manage the learning and behaviour of the whole class. In Mason's words, Mandy has a “collection of pedagogic actions” but does not yet have the confidence in a “narrative for elaborating and justifying their choice” (Mason, 2015, p.125).

### **‘Mastery’ and contingency**

This paper explored the connection between ‘mastery’ teaching and contingency in the classroom of a novice teacher, Mandy. The conception of ‘mastery’ displayed by Mandy places high demands on her subject knowledge and while I found that she was able to plan for ‘mastery’ in advance of a lesson, when pupils did not learn in the way that she had anticipated, her in-lesson responses deviated from the ‘mastery’ agenda; she seemed unable to draw on her subject knowledge and take the opportunities to deepen their understanding.

Well-meaning approaches by Mandy's SLT, designed to support her in teaching for ‘mastery’, appear to have limited her teaching as she is reluctant to change an approved plan in which she has invested so much time and thought. All deviations were viewed as undesirable by Mandy including those due to a moment of insight on her part.

Mandy's lack of confidence with maintaining a ‘mastery’ approach in contingent moments resulted in her missing opportunities to deep pupils' understanding. This may be because ‘mastery’ itself is a relatively new and somewhat nebulous concept, and is perhaps not yet integral to how mathematics teaching is approached. In that sense Mandy is a novice teacher of ‘mastery’. But Mandy is also a newly qualified teacher and is therefore a novice in every sense of the word; she is a long way from having “a repertoire of actions or practices, embedded in personal experiences, that can help bring those actions ‘to mind’” (Mason, 2015, p.123).

In the special issue on contingency, Coles and Scott (2015) report on the case of Hannah, a teacher who, like Mandy, did not welcome unexpected events in her classroom and was without a well-rehearsed response repertoire. With the expert support of Alf, she was exposed to rich experiences and challenged to think in new ways. He supported her to develop and rehearse a response repertoire which empowered her to recognise and seize opportunities, and to embrace contingency.

Hannah was supported by an expert to become an expert herself. She did not become an expert by filling out planning grids in isolation.

Whilst in Mandy's school she will no doubt have many colleagues who could act as an expert teacher to support the development of her general teaching skills, it is much less likely that there will be any who are regarded as expert 'mastery' teachers. This then becomes the dilemma. Is teaching for 'mastery' only within the grasp of a master teacher; an expert with a deep understanding of 'mastery' and a well-rehearsed response repertoire which reflects this? And were Mandy to be supported by an expert teacher of 'mastery' would she in turn become an expert teacher of 'mastery' herself?

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