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Market mirages and the state's role in professional learning: the case of English mathematics education

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ABSTRACT

Using a theoretical framework of policy assemblage, we analyse current primary mathematics teacher professional development in England, in the context of a transnational policy of mastery in mathematics influenced by East Asian practices. As well as the increased discourse of marketisation, and school and teacher autonomy, there has also been a paradoxical process of greater state influence over the content and form of professional learning. This paper maps the mathematics mastery market to show how marketisation and competition form a mirage that masks state-market assemblage. An analysis of these assemblages illuminates the state's role in fostering a market whilst also operating as an actor in this market, in this case in mastery professional development. Within the mastery market, tensions arise between the phenomena of replication and isomorphism and differentiation of 'offers' that develop affinity groups and networks. Thus, we extend previous descriptions of the hierarchy, markets, and networks, and the roles of state funded actors within teacher professional development by identifying the importance of multiplicity of logics, assemblage as a process of labour, and the dynamic nature of relationships and activity. Resources to support teacher professional learning are mobilised in competitive processes with apparent choice hiding state direction.

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Introduction

Increasingly, discourses of marketisation, performativity, accountability, and global competitiveness influence education in many national systems. In England, a complex dynamic occurs between marketisation and centralisation (Whitty 2008). The elision between the market and government direction of policy corresponds to a central contradiction identified in neoliberalism between deregulation and control (Brown 2015; Ellis, Mansell, and Steadman 2021). Although marketisation and centralisation may appear to be opposing forces, each results from other actors carrying out functions previously undertaken by the state (Ball 2012).

Much analysis of the relationship between the state and markets in educational reforms focuses on core aspects of education systems such as governance of schooling

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and initial teacher education. Recently, such analyses have been extended to the political economy of professional development in England, adapting concepts of the ‘shadow state’ (Wolch 1990; Trudeau 2008) to probe and understand the relationship between policy, funding, and various actors (Ellis, Mansell, and Steadman 2021; Steadman and Ellis 2021). In this paper, we refer to professional development and professional learning interchangeably, sidestepping debates about the use of terminology to refer to teacher change as either development or learning or both as this is not our central concern (for a discussion of this issue, see Adams 2017; O’Brien and Jones 2014).

The term ‘shadow state’ referred originally to voluntary sector institutions undertaking public sector activity administered externally but under the control of the state (Wolch 1990). It has been extended to account for the complexity of types of actors in education in England (Ellis, Mansell, and Steadman 2021; Steadman and Ellis 2021). Here, we build on and refine these analyses by considering a project of transnational curriculum reform and professional development in primary mathematics education in England.

The context for reform in England’s primary mathematics education is the government’s mastery policy. The ‘mastery’ and ‘teaching for mastery’ brands have become dominant in the marketplace for mathematics teacher professional development in England for primary teachers and school leaders. In England, mastery is a signifier for a variety of practices frequently linked to adapting East Asian mathematics teaching methods. ‘Mastery’ is a slippery word used in a variety of ways in formal texts and common discourse to refer variously to curriculum, approaches to teaching, a level or type of mathematical understanding (Boylan 2020; Boylan et al. 2018; Boylan and Townsend 2017).

Our concern is not with whether the mastery approach to mathematics teaching is better than previous practice. There is inconclusive evidence for the efficacy of aspects of mastery pedagogies (Boylan et al. 2018) and programmes (see Boylan et al. 2018, 2019; Jerrim and Vignoles 2016). Similarly, our analysis does not entail a judgment of the value of the professional development that teachers experience. Indeed, at least some teachers who participate have compared mastery professional development favourably with previous experiences (Boylan et al. 2019; Boyd and Ash 2018). Thus, this paper is neither a critique nor a promotion of any variants of mastery pedagogy or of mastery professional development. Rather, we focus on the mastery market and how analysis of this shows that neoliberalism saturates the educational space, not as a totalising force but as ‘a migratory technology of governing that interacts with situated sets of elements and circumstances’ (Ong 2007, 5).

‘Mastery’ in England is promoted by a government-funded body – the National Centre for Excellence in Teaching Mathematics (NCETM) – tasked with improving mathematics education. The NCETM coordinates a network of Maths Hubs, partnerships of schools, colleges, and other education organisations. However, the NCETM is not the only purveyor of mastery. Other mastery offers are available, within an educational landscape involving complex relationships of hierarchies and networks between schools. This landscape is populated not only by schools, and groups of schools in academy trusts, but also by a variety of other actors, including entrepreneurial social enterprises and private educational businesses. Prefiguring a discussion below, we consider the mastery policy, discourse, practices, and sociomaterialities as an assemblage,

a ‘heterogeneous composition of complex social and non-social formations’ (Savage 2020, 320).

In this paper, principally through documentary analysis, we consider multiple logics found in the processes of assemblage that lead to fluidity in positioning of actors, and also to complexity in their relations not only to the state but to other diverse actors including multinational corporations and educational ideologies – conceptualised through the notion of curriculum entrepreneurs. By analysing mastery and mathematics professional development as assemblage, we show how the promotion of a market clustered around mastery is important to the processes of assemblage but is also often a mirage or illusion concealing more directive policy. The state not only promotes and regulates the market in public goods but is also an actor competing in the market it has created: we refer to this phenomenon as a state-market assemblage of professional learning. This concept of state-market assemblage refers to the apparent promotion of market mechanisms – with different competitors – that hides state direction. This suggests that the conceptual framework of shadow state needs extending to account for processes of assemblage. In addition to these theoretical concerns, we consider the implications for teachers and schools positioned as consumers in the mastery market.

In the next section, we provide the policy background relevant to mathematics professional development in England. We then theoretically position the analysis in relation to sociomaterial analyses of educational policy and to conceptions of assemblage in critical policy analysis. We describe the rationale for the selection of texts and the methods of analysis. Thus, we provide the basis for an analytical account of the professional development system – the mastery market pertaining to primary teachers and schools, we use ‘market’ and ‘state’ heuristically, given the assemblage perspective adopted (Savage 2020). We identify the ways this market is restricted and use the concept of state-market assemblage to refer to the tensions between marketisation and the role of the state. Within the mastery market, tensions arise between two tendencies: replication of features of assemblage, and differentiation of ‘offers’ that promote affinity groups and networks. We examine the key issues and implications including the challenge of navigating the mastery market for school leaders and teachers.

Our analysis arises from our positioning not only as researchers located in the system in change but also (to a relatively minor extent) as actors in the process of shaping policy. Between 2014 and 2018, we were part of the team that evaluated a central aspect of government mastery policy – the Mathematics Teacher Exchange (reported in Boylan et al. 2019). This research and evaluation experience informs our analysis and arguments.

Neoliberalism, the English education system, and professional development

Neoliberal influences in education are concurrent and often intertwined with tendencies towards globalised educational reform as in the case of the mastery policy (Ball 2016; Ellis, Steadman, and Trippestad 2019; Sellar and Lingard 2014; Rizvi and Lingard 2010; Sahlberg 2011; Hogan, Sellar, and Lingard 2015; Zeichner 2010). We use neoliberalism here to refer to the extension of markets and competition in education as a disruptive force aiming both to change educational outcomes and to dissolve boundaries between public education and private sector activity (Davies 2014).

The trajectory of neoliberalism in English education has been the subject of extensive research (see, for example, Ball 1999, 2008, 2009; Hill et al. 2016; Maguire, Braun, and Ball 2015; Page 2018; Wilkins 2017). Neoliberal reforms in school governance have promoted apparent school independence through a process of academisation whilst supporting the maintenance and extension of accountability measures and prescriptions on curricula and assessment. The nature of the resulting complexity has led Lawn (2013) to argue that education in England is a 'systemless system' or even a business experiment.

Greany and Higham (2018), in their study of what the government in England has styled as a 'self-improving system', identify three modes of governance mapped to hierarchy, markets, and networks:

- hierarchy – the formal authority exercised by the state through policies, bureaucracies, and accountability measures including inspection and powers to intervene to change governance of schools.
- markets – policy frameworks to foster competition, contestability, and commercialisation; and, pertinent to the study of mathematics teacher professional development, encouragement for a marketplace in school improvement services.
- networks – encouragement or coercion of inter-organisational collaboration, partnership, and participation.

In teacher professional development, the contexts of hierarchy, markets and school networks (Greany and Higham 2018; see below) and similar groupings are important in shaping the enactment of the mastery policy. Professional learning is tied to school and system improvement. Central to this are increasingly powerful and large chains of multi-academy trusts (MATs) and schools (often part of MATs) formerly designated as Teaching Schools. This designation was introduced in 2010 to lead initial teacher education and professional development (Department for Education 2010) and replaced in 2021 by Teaching School Hubs.

Greany and Higham's analytical units are schools and groups of schools. However, extending the analysis to a national level would include actors bidding for contracts to carry out policies with various degrees of apparent and actual competition and transparency (see Ellis, Mansell, and Steadman 2021). Similarly, and related to the awarding of contracts, there are less benign and accountable forms of network where:

education and consultancy businesses are firmly embedded in the complex intersecting networks of policymaking and policy delivery and various kinds of transaction work (brokerage and contract writing) - much of which is hidden from view. 'Statework' is done through multiple relationships and responsibilities in and in relation to educational governance - the businesses act as advisers, evaluators, service deliverers, philanthropists, researchers, reviewers, brokers, 'partners', committee members and as consultants and auditors (Ball 2009, 89).

This complexity, particularly, in the context of transnational policy flows, requires investigation of how neoliberalism manifests in specific sites (Peck and Tickell 2002). As noted above, important in these debates is the role of the state in education in 21st Century education systems such as in England where neoliberal reforms have been pursued. Clearly, the roles of the state (national and local) as responsible for, and

provider of education, as a public good have changed. Ball (2012) suggested that the extension of academisation and the new governance networks represent tendencies towards ‘destatisation’ and could lead to the end of state education. At the same time, the ‘new patchwork’ of educational provision requires new and increased roles of coordination.

In relation to teacher professional development, Ellis, Mansell, and Steadman have revisited concepts of the shadow state (Wolch 1990; Trudeau 2008). They analysed teacher development funded under England’s Teaching and Leadership Innovation Fund (TLIF) and identified three types of shadow state structures funded to deliver teacher professional development. Autonomous shadow state structures are politically and economically independent and do not rely on TLIF funding. Intermediate shadow state structures are viable beyond the particular funding stream but are highly reliant through other contracts on state funding. Cocreated shadow state structures are newer, situated close to policy-makers, and for each of these entities, the TLIF contract was important to short- or medium-term viability. Contractors were also analysed by their enterprise type: entrepreneurs (commercial businesses), scholarly enterprises, or enterprising charities. The involvement of these three types indicates how the shadow state has developed from original theorisation of voluntary organisations’ roles. Central to the understanding of the political economy of TLIF is the ideology of the Conservative government which combines a commitment to competition (or at least its appearance) and markets with ‘a more paternalistic commitment to control, traditional moral values and cultural nostalgia’ (Ellis, Mansell, and Steadman 2021, 616). This was particularly apparent in the decision to fund teacher development in phonics and behaviour management.

Mastery professional development

In this section, we provide a short summary of the history of mathematics teacher professional development in England, and the recent influence of transnational policy flows, as background to describing mastery professional development. Before and immediately after the introduction of the English National Curriculum in 1990, professional development was often initiated by teachers themselves (Adams and Povey 2018), by schools or through Local Education Authorities. From 1998 to 2005, the introduction of the National Numeracy Strategy, the National Literacy Strategy, and, later, the National Strategy entailed a more centralised, national direction of professional development. However, in keeping with ‘arms-length’ (Exley 2016) or shadow state (Ellis, Mansell, and Steadman 2021) governance, the National Strategy was ‘delivered’ under a competitive contract by a non-profit social enterprise, the Centre for British Teachers (CfBT), and later by a for-profit provider of services to the public and private sectors – Capita.

The introduction of the National Centre for Excellence in the Teaching of Mathematics (NCETM) and its activity during its early period (2006–2010) signalled renewed support for autonomy and plurality, backed by national enabling leadership, with the NCETM taking the role of broker and supporter of teacher networks (Boylan 2018). During this period, the role of the National Strategy infrastructure in school improvement and professional development reduced, as did the role of local government.

From 2010, the role and aims of the NCETM changed, under Conservative-led coalition and Conservative governments. The NCETM continues to be the main policy actor in mathematics teacher professional development. Since 2014, implementing government policy to align mathematics teaching with East Asian practices has been a principal focus. A consortium manages the NCETM on a rolling contract, in which Tribal – a for-profit educational services provider – employs and manages NCETM staff with the significant involvement of a charity – Mathematics for Education and Industry – as well as other consortium partners. The NCETM was reliant on government funding, so according to the Ellis, Mansell, and Steadman (2021) shadow state typology, it is a co-created structure. However, the NCETM's contract has been held by a changing consortium of organisations that could be characterised as either autonomous or intermediate structures. The consortium has consisted of entrepreneurs (commercial businesses), scholarly enterprises, or enterprising charities (again referring to the shadow state typology). This arrangement indicates that the relationship between state and state actors is multiple and complex.

We have provided accounts of the introduction of and rationale for the mastery policy elsewhere (Boylan 2020; Boylan et al. 2019; Boylan and Townsend 2017), which we summarise here. From 2013, the government in England has developed an increasing interest in mathematics teaching in East Asian and specifically Shanghai and Singapore due to these jurisdictions' current success in transnational assessments including the Programme for International Student Assessment (PISA). By adopting East Asian practices, government ministers believed that England's performance in these comparative assessments would improve (Gibb 2016). The government initiated a teacher exchange with Shanghai and tasked the NCETM to coordinate this. This happened alongside the development of the Maths Hubs.

Below, NCETM's mastery 'offer' is described in more detail, alongside other professional development providers in the mastery market. The specifics of mastery aside, the NCETM has multiple roles – multiplicity often being a feature of assemblage. The NCETM is an implementer of policy but has also influenced policy through its negotiation with government officials. It provides professional development directly – most notably by training mastery specialists. It also shapes the professional development market by certifying the quality of other providers' professional development. It publishes materials that can be used in professional development and in teaching whilst providing a web portal that links to other materials and assesses publishers' textbooks to determine if they are eligible for purchase with a government subsidy. Similar complexity is found in other actors in mathematics teacher professional development, hence the value of assemblage analysis which we turn to in the next section.

Policy, assemblage, and analysis

Policy and policy effects as assemblage

We consider the relationship of policy to enactment as one of assemblage – both influencing and helping to constitute the broader mathematics professional development assemblage in England. Our use of this concept is informed by:

- critical policy studies (Baker and McGuirk 2017; Clarke et al. 2015; Collier and Ong 2005; Gorur 2011; McFarlane 2009; Savage 2020; Sellar and Lingard 2014) where the term is used in policy studies to analyse global education trends and policy flows as assemblages.
- sociomaterial analysis of professional development (Boylan 2010; Fenwick and Edwards 2011; Fenwick, Nerland, and Jensen 2012; Fenwick 2011)
- more general social theory drawing on philosophical conceptions of assemblage (Allan and Youdell 2015; Deleuze and Guattari 1987).

More recently, the link to the concept of assemblage in critical policy studies is that of policy mobilities (Ball 2016). These uses are particularly pertinent given the transnational influences on mathematics education policy in England (Boylan et al. 2019). The focus on assemblage in global policy studies echoes sociomaterial analyses of professional learning (Boylan 2010; Fenwick and Edwards 2011; Fenwick, Nerland, and Jensen 2012), educational reform (Fenwick 2011; Allan and Youdell 2017) and transnational policy flows in education including specifically the policy influence of PISA (Gorur 2011). Sociomaterial analyses of educational reform seek to trace how apparently distinct parts of the assemblage are relational effects of each other (relations of interiority) and external entities beyond the assemblage (exteriority). Such concepts disrupt the notion that policy innovations are like kernels that then encounter and are encircled within a containing context (Nespor 2002).

An assemblage is the product of multiple determinations that are not reducible to a single logic; the focus in policy assemblage is on relations and connections between component parts (Savage 2020). The temporality of an assemblage is emergent:

It does not always involve new forms, but forms that are shifting in formation or at stake. As a composite concept, the term ‘global assemblage’ suggests inherent tensions: global implies broadly encompassing, seamless and mobile; assemblage implies heterogeneous, contingent, unstable, partial and situated (Collier and Ong 2005, 12).

Assemblage draws attention to the processes of construction as well as the relative and differing fragility of assemblages – pointing to a dynamic of solidity and fragility (Clarke et al. 2015). Baker and McGuirk (2017) offer a framework of four commitments for the use of assemblage in critical policy studies which we summarise here using their original numbering.

- (1) multiplicity of logics – which extends both to internal and external relationships and thus may not display internal coherence (McGuirk and Dowling 2009); multiplicity does not deny asymmetry in the extent to which different logics or forces are determinant in processes.
- (2) an orientation to process as contingent and requiring empirical investigation, and constantly in flux.
- (3) that assembling is a process of labour and agency.
- (4) embracing uncertainty and so rejecting rigid or fixed explanations for those that are provisional.

Some commitments foreground epistemological and methodological concerns contingent processes, and uncertainty and provisionality. These particularly informed the research process and analysis. Others either emphasise ontological commitments – or these flow from them, namely: multiplicity of logics, assembling as a process of labour and agency and policy assemblages in flux. The latter follows from multiplicity and agentic labour and alternatively is described through concepts of policy mobility (Ball 2016; Savage 2020). These three features inform the resulting description of the state-market assemblage.

Policy texts and texts in policy translation

To understand the mastery assemblage, we analysed policy texts and texts arising from policy or closely related to it, considering a policy text as any means by which a policy message is carried or transmitted (Ozga 1999; Rizvi and Lingard 2010). However, in understanding how policy moves, it is important also to consider texts that are formed in response to policy texts – so translating policy or adapting to it. Thus, we view policy as mobilities (Ball 2016) and processual understandings of policy, focusing on policymaking as enactment rather than focussing only on original policy texts (Rizvi and Lingard 2010). In relation to the mastery policy, there were no formal policy documents such as legal frameworks or publications proposing the mastery policy. Rather, the policy was communicated and developed through political speeches and press releases from England's Department for Education (DfE 2014; Gibb 2016; Gove 2012) and media reports of government positions or activities (for example, Elgot and Phillips 2018) as well as those documents produced more distantly or as policy was translated and enacted.

The latter sets of texts include those shaped by the DfE either directly or by bodies funded or commissioned by the DfE, and with varying degrees of negotiation and contestation. Thus, also included in the corpus are the NCETM documents (for example, NCETM 2014; 2016) and our own evaluation of one aspect of the mastery policy – the Mathematics Teacher Exchange – in which various policy positions supplied to the evaluation team were summarised (Boylan et al. 2019). The Mathematics Teacher Exchange evaluation report also summarises ways in which teachers have translated policies.

Published research texts were supplemented by other material produced in the evaluation such as records of meetings or interviews with government officials or others responsible for policy implementation. These were further supplemented by texts – generally located through web searches – produced by bodies promoting other versions of mastery or materials and programmes that are presented as complementary to those of the NCETM (for example, Mathematics Mastery n.d.), and in some cases in relation to these other mastery programmes' evaluation or research artefacts (though these are limited). Thus, texts extended to samples and descriptions of curriculum materials and video materials. Some material had multiple purposes, being both promotional and educational in that they had a professional learning purpose. A summary of the texts and sources analysed is provided in Table 1.

For the seven mastery CPD actors, exactly quantifying material would be misleading as it was presented in a variety of ways across sites, and for some actors in documents in

Table 1. Corpus of texts analysed.

Type of text	Examples	Number
DfE formal and informal policy documents	DfE reports, transcripts of government speeches, press releases	9
Policy enactment documents	NCETM documents, newsletter articles, professional development materials, Maths Hub sites	9
Research texts focused on mastery	Evaluation reports and academic publications on mastery innovations	12
Media reports	Media reports on mastery and the Shanghai Teacher Exchange, media reports on local initiatives, e.g. mathematics programmes' press releases	12
Mastery programme websites and materials	Texts/sources retrieved from websites of White Rose, Power Maths, Inspire Maths, Mathematics Mastery, Maths - No Problem!, Complete Maths and La Salle Education, national Maths Hub web pages and a selection from local hub sites supplemented by books or other texts associated with mastery actors	See below

the wider corpus, this was relevant particularly for the NCETM. We examined online sources to collect data from web pages and embedded videos on:

- the origins of the organisation and/or programme
- the organisational system including the legal entity providing the professional development
- pedagogical philosophy and intended practices
- the modes of professional development – workshops, coaching
- form of curriculum materials and where available examining examples
- relationships with and engagement with schools including designation of schools, and forms of networks promoted (if any)
- written texts associated with mastery actor that explained/expanded on the approach and relationship with the government, including funding if applicable.

This entailed reviewing the site map, visiting all relevant site pages, and then printing copies of pages which had relevant data, typically 10 or more sources for each actor. The selection of data followed the requirements of the analytical approach described in the next section and was shaped by the focus on the policy analysis of the mastery market rather than to compare the forms of mastery on offer. The number of sources is indicated in [Table 1](#) to give a sense of the corpus. As mastery developments were dynamic and in flux (Baker and McGuirk 2017), scoping review of websites took place in 2018, more focused website visits and data retrieval in 2019, and page revisits in 2021 and 2022.

Analysis

In keeping with the theoretical framework, analysis traced associations between actors in the assemblage, and processes of translation. As described above, two commitments important in the analysis were an orientation on contingent process and an embrace of uncertainty and flux. Baker and McGuirk (2017) summarise assemblage ontology research practices flowing from these commitments. The first is an ethnographic sensibility – and for the study in this paper we underline the process of defamiliarisation in reading texts – whereby texts are treated:

as ethnographic artefacts that provide windows into the mobilisation, creation and application of policy knowledge. These artefacts function on the one hand as texts that reveal particular ways of thinking and acting, and on the other, as lively texts whose itineraries and effects can be apprehended by following their ‘traces’ in different contexts (434).

The second practice, the notion of tracing is itself an important methodological tool that focuses on mobility rather than only on boundaries and differences between parts of an assemblage. The third aspect of the analysis is to pay particular attention to the work of assemblage and how policy is assembled.

Baker and McGuirk (2017) summarise the triad of analytical dispositions:

an ethnographic sensibility is concerned with “how to look”, and tracing sites and situations is concerned with “where to look”, a methodological practice directed to the task of revealing labours of assembling is concerned with “what to look for” (437).

These approaches informed both the identification and analysis of texts. A central thread in this tracing was to look at how the meaning of mastery itself moved across texts, including sometimes the term, or particular meanings and articulations, being notably absent and then reappearing. The analysed texts were produced over time, so as well as tracing how the meaning of mastery changed as it moved from site to site, we also tracked how the meaning changed within sites or came to appear and be adopted in them. The most visible example is the change from mastery approaches to ‘teaching for mastery’ in NCETM texts.

As part of the ethnographic sensibility, we note our positioning within and as part of this assemblage. The evaluation of the Mathematics Teacher Exchange (Boylan et al. 2019) and associated reports, together with dissemination activities through educational media and social media, were part of the assemblage and did work in assemblage processes. The next sections provide the outcomes of this analysis.

Actors in the mastery market

The current focus on East Asia as a source of curriculum change and professional development in mathematics predates the development of the teaching for mastery programme (Boylan et al. 2019). In 2007, the *Maths – No Problem!* (see below) translations of Singapore textbooks were produced. In 2012 and 2013, two study visits to Shanghai were funded by England’s Department for Education. The first teacher exchange with Shanghai took place in 2014/15 and the exchange programme has been at the centre of government mathematics education policy since. Shanghai had become a PISA reference society (Sellar and Lingard 2013), but also this was due to a trade policy that sought vehicles for closer economic ties (Elgot and Phillips 2018). The latter extends education as economic policy (Rizvi and Lingard 2010) from the production of human capital to more directly a form of economic exchange.

As well as the NCETM, other key actors in the market are now described. We use market here as a heuristic (Savage 2020). These actors are presented in chronological order according to when the different actors made explicit reference to mastery or when their professional development programmes were linked to the government’s interest in East Asian mathematics education. This charts the point of actors market entry. The array of different market actors means there are alternatives to engaging with Maths

Hubs and the NCETM. In addition to the more significant actors described below, there are also individual or small local teams of consultants who may refer to mastery, many of whom may be accredited as CPD providers by the NCETM. Teaching Schools supported mathematics teacher professional development that was separate from Maths Hubs, often through teachers or school leaders previously designated as Specialist Leaders of Education (Close and Kendrick 2019).

Maths - No Problem!

Maths - No Problem! started in 2007 and is based around translations of Singapore textbooks supported by a programme of professional development and online activities. Thirty-five schools in England are listed as accredited providers, mainly clustered in London, the South-East, and the North-West. These schools offer support to new adopters in the form of open days and informal support. More recently, *Maths - No Problem!* has taken up reference to mastery in its promotional materials, although this was not language used prior to the Mathematics Teacher Exchange.

Mathematics mastery

In around 2009, the Ark multi-academy trust looked to Singapore for ideas as well as to other education systems that were deemed to be high performing, as well as practice in England. Ark is part of an international entrepreneurial organisation with a social mission fitting with models of global philanthropic governance (Olmedo 2014). However, the mastery approach that was developed for Ark's programme is rooted in developments in England (see Drury 2015). *Ark Mathematics* was renamed *Mathematics Mastery* around 2010 and was supported by Education Endowment Foundation funding for development and evaluation (Jerrim and Vignoles 2016). This appears to be the first time the term mastery was used in relation to East Asian mathematics, at least in England. *Mathematics Mastery* has continued to develop and grow, with currently around 500 schools (mainly primary) involved in the programme (Mathematics Mastery n.d.).

Complete Maths and La Salle Education

La Salle Education, founded in 2013, is a provider of mathematics professional development. Its programme is titled *Complete Maths*. La Salle holds an annual conference attended by hundreds of teachers and it runs the Mathematics Teacher Network, which is linked to AQA, an English examination board. La Salle Education's founder, previously a senior figure in the NCETM, has long been a proponent of mastery learning informed by Bloom and successors. More recently, La Salle has been using the term 'teaching for mastery' (e.g. McCourt 2019) – the NCETM's chosen term and linked by them to Shanghai and East Asia. However, La Salle's use of 'teaching for mastery' does not appear to represent a change in their pedagogical view. Rather, we infer that it is an attempt to contest the space that NCETM has occupied and to claim back the name 'mastery' for the longer-standing mastery learning tradition.

Inspire Maths

The Oxford University Press publishes a translation of Singaporean textbooks – known in England as *Inspire Maths*. One of the authors is a consultant who works for La Salle Education but Inspire is distinct from La Salle. Inspire has ‘20 advocate schools’ across England that promote its programme. The publishers also offer professional development linked to the textbooks. *Inspire Maths* was one of the two textbooks that were part of a pilot NCETM/Maths Hub-led textbook pilot scheme, with funding provided for selected schools to purchase the books. As the policy focus on East Asian mathematics and mastery developed, Inspire adopted the term mastery.

Ncetm

By 2014, the National Centre for Excellence in Teaching Mathematics (NCETM) had adopted the term ‘mastery’ and was writing about mastery approaches (NCETM 2014). Later, the term ‘teaching for mastery’ was adopted (NCETM 2016).

The NCETM’s teaching for mastery programme, developed since 2014, consists of a range of interconnected activities which promote pedagogy formulated as ‘teaching for mastery’ (TfM) (NCETM 2014; 2016). The TfM programme consists of a professional development programme to train mastery specialist teachers, support for the specialists to work with groups of teachers from local schools (mastery advocates), a subsidy to support purchasing textbooks, and further exchanges with Shanghai teachers. The main aim is for over half of English primary schools to engage with the TfM programme in some way; the approach is also advocated in secondary schools. The funding for the TfM programme is a small fraction of the amount available for schools when the National Numeracy Strategy was introduced (DfEE 1998).

Maths Hubs and mastery specialists

A national network of ‘Maths Hubs’ in England is funded by government to promote and organise professional development opportunities. Maths Hub lead schools are identified through a competitive bidding process and are embedded in what is styled as the ‘self-improving school system’ (Greany and Higham 2018) mentioned above. Maths Hubs are managed by the NCETM.

Connected to the Maths Hubs and NCETM is a cadre of mastery specialist teachers. These in turn organise mastery work groups with teachers who undertake to lead change in their schools, thus diffusing mastery practices further. Annually, mastery specialists host teachers from Shanghai, providing opportunities for teachers from other schools to observe Shanghai teachers. For some of the mastery specialist teachers there is also an opportunity to go Shanghai as part of the Mathematics Teacher Exchange (Boylan et al. 2019).

White Rose Maths

White Rose Maths originated from a Maths Hub. Maths Hubs chose their own names, and one serving the West Yorkshire region chose ‘White Rose’ – an emblem long

associated with Yorkshire. The White Rose hub was led by Trinity Academy which in turn was the sponsor school (lead school) of a multi-academy trust. Early in the development of mastery policy, the White Rose hub produced and shared online programmes of study – described as schemes of learning aligned with the 2014 Mathematics National Curriculum. These were very popular and downloaded by large numbers of users. White Rose began to develop additional materials and professional development offers that went beyond their region. White Rose became a separate educational business and the Maths Hub, still led by Trinity Academy, was rebranded as the West Yorkshire Maths Hub.

White Rose now offers a range of free resources and materials including the schemes of learning, as well as premium materials and a range of training packages for sale. It lists one of its partners as the Times Education Supplement (TES). TES is the oldest publication for teachers in England and has the largest circulation. Now, as part of TES Global, it hosts a platform for the sale of curriculum materials including downloadable material. TES Global is owned by TG Capital, a private equity firm. TES hosts White Rose materials.

Power Maths

Power Maths was designed to align with *White Rose Maths*. It is a market entrant from Pearson, a global multibillion-dollar educational business (Hogan, Sellar, and Lingard 2015; Singer and Thompson 2017). Pearson's interests in *White Rose Maths* appear to be due to the latter's reputation, standing and reach through its schemes of work in English primary schools. The *Power Maths* scheme textbook has Chinese coauthor/consultants, providing a Shanghai link. The textbook programme was judged to meet the requirements of the government textbook subsidy, and the publicity material states it is recommended by the DfE. Subscription to *Power Maths* also gives users access to half-termly assessments to monitor student progress. *Power Maths* offers less within its programme in terms of professional development, compared to other actors. It provides this type of support through videos rather than professional development events. This may be due to its link with White Rose which has a national professional development programme.

The state and the mastery market

In this section, we exemplify the relationships between the state and the market in professional learning through an analysis of the resourcing of 'teaching for mastery', an increasingly dominant strand in the market for primary mathematics teacher professional development in England since 2014. We focus on the way that government contracting, and subsidies operate to shape policy and practice. In relation to mastery teacher professional development in England, 'market' has two meanings: the competition between mastery providers for teachers or schools as consumers, and the competition between providers in relation to the government as purchaser and funder.

Considering the first form of market, teachers, schools, or groups of schools organised as multi-academy trusts can purchase mastery professional development and curriculum materials, or they may sell such educational goods. Because of the power of government

contracting and school funding, the mastery market is not a 'free market' in the sense that the 'consumers' of professional development (teachers or school leaders) can freely choose what types of professional development to engage in. Their decisions are heavily constrained by performativity pressures and the way government ideology and policy shape accountability tools such as the Ofsted inspection framework. Ofsted is the school accountability agency in England that passes judgments on schools (Boustead 2020). Relations and decisions are contingent and in flux influenced by global policy shifts and pressures (Baker and McGuirk 2017).

Thus, potential providers of professional development do not have the same opportunities or support for providing educational goods or services. One reason for this is the second form of market which underlies the more visible one. Even more opaque is the competition for government contracts that can allow actors to maintain or build market share, as similarly identified in relation to phonics professional development and schemes (Ellis, Mansell, and Steadman 2021). Reliance on contracts brings with it a precarious market position: the NCETM could potentially lose its contract to one of the other players in the market, particularly if that player is linked to an organisation like Tribal. Thus, contracting practices allow the government to influence the focus of professional development and mathematics teaching in schools, but doing so in ways which mask the degree of influence or direction. Conversely, reliance on contracts incentivises actors to engage in policy work to ensure that policy continues to align with their offers.

A more direct way in which the government shapes the market offer is through a subsidy for textbooks. Prior to the introduction of the mastery policy, the use of textbooks in primary mathematics was rare in England. Promotion of increased use of textbooks has been a generic, though quasi-official, aspect of government educational policy. In 2015, the government's minister for school reform wrote a foreword to a paper promoting textbooks (Oates 2014). More recently, government support for textbook use has been directed through textbook subsidies.

From 2017, the government set aside some of the money for the mastery policy to fund a textbook subsidy (Boylan et al. 2019) available to mastery specialists and schools participating in the work groups. The subsidy reduced textbook costs by 50%, up to a total purchase of £5000. Initially, only one textbook was approved: *Maths – No Problem!* (Ward 2017). Then Pearson, in association with *White Rose Maths*, entered the market with *Power Maths* and their textbook was also approved. The panel approving textbooks consisted of an NCETM representative (at the time leading the teaching for mastery initiative), a proponent of textbook use (who had previously advised the DfE) and an independent educational consultant (Ward 2018). As noted above, Pearson is a multibillion-dollar business with all that entails in terms of the capacity for lobbying and influence, existing contractual relationships with government, and the power of a considerable marketing budget. This push for greater use of textbooks through encouragement of publishers to enter the market is an instance of a state-market assemblage hidden behind a market mirage. There is a transfer of responsibility for resourcing professional development, in pursuit of a government policy agenda, from the government to schools and individuals (Shore and Wright 2011).

Although Maths Hubs have contracts and deliverables, as does the NCETM, these are not transparent in that the performance indicators or contractual arrangements are not

disclosed. The NCETM is an example of what Ball (2009) termed ‘endogenous privatisation’. Considering the shadow state metaphorically, the NCETM is not only part of the shadow of the state but the details of its relationships to the state are in the shadows.

When it was established, the NCETM held a clear and unambiguous national warrant (Boylan 2018) as *the* centre for teaching mathematics. It now competes with a variety of other organisations and bodies. At the same time, the NCETM also has a role in regulating this potential competition through the textbook approval process. These different activities underline both the multiplicity of logics in the NCETM role and the labour undertaken both in its own assemblage processes and in contributing to the mastery assemblage. Thus, there are contradictions and tensions at the heart of the policy approach; as noted above, this underlines the observation that whilst typologies may be helpful in identifying different types of quasi-state actors, their relationships are shifting, complex, and more dynamic than discrete categories can describe.

Replication and isomorphism

Having provided a description of the largest actors in the mathematics mastery market and the tensions evident in the state-market assemblage, we now consider how the market influences replication of practices and relational forms in assemblages, using examples from our earlier description of the market. We draw on the extended framework discussed above based on features informed by Baker and McGuirk’s commitments.

The following types of entities, roles, and relationships are found in market actors:

Professional development and learning activities – in the form of programmes, events, artefacts, and materialities; often there will be different levels or tiers of professional development, for example introductory or aimed at professional development leaders (PDL)

Teaching resources and curriculum materials – textbook or alternative coherent sets of materials

Hierarchies of expertise – often with an external expert authority who acts as a pedagogical entrepreneur, as well as PDL leaders/consultants and local PDL teachers; for example, in the NCETM programme these PDLs are trained mastery specialists who then work with school-based coordinators. Thus, expertise and authority are relative.

Affiliations – schools have designations or other markers of affiliation such as advocate or specialist schools.

A mastery warrant – often this is found in marketing materials, with explicit links to East Asia, to evidence, prior research or external authority that transcends the local; the key here is a reference to mastery itself, or Shanghai or East Asian success and/or success on PISA.

Organisational and business infrastructure – pedagogical and curriculum entrepreneurs are complemented by business entrepreneurs, for example an educational publisher.

These entities, roles, and the relationships between them are in constant flux. So, an entity with an initial focus on providing professional development may subsequently develop curriculum or professional development materials (for example, NCETM) including by creating a relationship with a publisher (White Rose and Pearson’s *Power*

Maths). Here we recognise the labours of assembling and, associated with this work, the way that agencies (material and human) act in this. Alternatively, a developer of curriculum materials may develop a professional development programme (for example, *Maths – No Problem!*, *Mathematics Mastery*) that draws heavily on East Asian influences. Alongside curriculum and professional development, the mastery actor may recruit a cadre of consultants, develop teachers as specialists (NCETM) and develop relationships with groups of schools who gain status as ‘accredited schools’ (*Maths – No Problem!*).

Other mastery actors support the curriculum differently rather than with a textbook. For example, the NCETM published professional development materials adaptable for classroom use and other curriculum and teaching resources. Another influential set of resources is produced by *White Rose Maths*.

Alongside replication of practices and relationships, discourse is also replicated. The same phrases circulate across different actors, subtly changing meaning as they move. Examples include ‘small steps’, ‘intelligent practice’, ‘concrete-pictorial-abstract’, ‘depth’, and ‘deep learning’ as well as the ubiquitous ‘teaching for mastery’. These phrases appear in documents and websites produced by different actors: for example, in the *Maths – No Problem!* website, Pearson’s *Power Maths*, as well as the NCETM website, professional development materials and promotional materials. Acting as markers and associating actors with mastery, discourse acts as a means of assemblage. Thus, different actors in the mastery market have a degree of organisational isomorphism. This isomorphism arises from mechanisms of power (coercive pressures), attraction (normative pressure) and mimesis (mimetic/imitational processes) previously identified in organisational theory (Beckert 2010). Additionally, ideological mechanisms are important, particularly in relation to what constitutes desirable mathematics teaching and teacher professional development.

That there is isomorphism does not mean that these markers and tools have the same meanings and functions in different mastery assemblages. As they arise from labour and processes of assemblage, a logic of multiplicity is apparent, and uncertainty emerges (Baker and McGuirk 2017). A logic of multiplicity in this context means that this not a singular linear determination shaping actor in the mastery market and their materials, professional development activities, and ecosystems. They are shaped by an ensemble of interacting policies, projects, actors, and materials. Uncertainty follows as the determinants in any particular part of the mastery assemblage cannot be predicted.

Further, although the dominant tendency is towards replication, as part of brand building, a countervailing though weaker tendency is towards differentiation to distinguish actors from competitors. This process of exteriority (McFarlane 2009) through differences helps to explain why particular masteries or ‘teaching for mastery’ variants arise. Some mastery assemblages have professional development at the centre; others are centred on curriculum materials. The same forces that lead to isomorphism and convergence can also generate divergence.

Marketisation, power, and network affinities

In this section, we consider what the analysis of the mastery market indicates about the educational assemblage in England. Ball (2009) identified how shifts to network

governance, marketisation, and privatisation led to education businesses taking up new policy ideas in the first decade of the century. Promotional materials made claims to expertise, highlighted links to the government's agenda, and reflected the new public management discourses of government. A similar process is evident in the mastery market.

Moreover, teachers' and schools' participation in mastery is shaped by forces of performativity and accountability. School participation may lead to gaining status in a particular mastery ecology, leading to publicity and visits by other schools. Mastery specialist schools host Shanghai teachers as part of the Mathematics Teacher Exchange. Mastery designation has currency for schools and teachers.

Whilst the threefold features of hierarchy, markets and networks identified by Greany and Higham (2018) are useful for understanding the English education system – or non-system as Lawn (2013) contends – identifying hierarchy with state authority may mean missing the hierarchies that exist, by design or as emergent features, within markets and networks, underlying that process is contingent and requiring empirical investigation (Baker and McGuirk 2017). To participate in the Mathematics Teacher Exchange and to participate in the mastery specialists' professional development programme, a selection process takes place with a criterion being schools' and teachers' capacities to support other schools. Selection is therefore constrained by variation in schools' capital which underpins capacity to engage in such activity (see Boylan et al. 2018) with obvious implications for equity.

Details of how professional development is funded and what relationships exist between actors are obscured to teachers and school leaders. As noted above, schools (and teachers) have differing opportunities to engage and participate in professional development. Some are entrepreneurial – notably those formerly designated Teaching Schools; they provide professional development to others. Other schools are positioned more as consumers, and others under accountability pressures may find it difficult to participate at all (Boylan et al. 2018). Even professional development that is offered 'free' or with financial subsidy is not equally accessible due to the cost of having staff out of class. Schools with Ofsted judgments of 'requires improvement' or with staffing pressures are less able to access professional development opportunities (Boylan et al. 2018).

Consideration of the mastery market indicates two ways to extend understandings of networks between schools. The first is to consider relationships with other educational actors – in the case of mastery, organisations such as NCETM, White Rose, and various publishers. This expands what is salient when analysing networks. The second extension is the importance of network affinities. Actors in the mastery market tend to offer a coordinated package of professional development, curriculum materials, and support. Teachers may experience affinity and belonging stemming from participation in professional development, using curriculum materials and other related activities. Thus, teachers and schools develop affiliations with a particular mastery approach or assemblage. Here, differentiating from other offers in competition serves to enhance the connections between schools in a network (related to a particular form of mastery) whilst perhaps also creating divides between these networks.

Table 2. Features of the professional learning assemblage.

Features	Examples
Multiplicity of logics	Processes of funding, private enterprises interacting with social enterprises and school organisations Actors responding to multiple agendas, goals and incentives, and with multiple roles e.g. NCETM
Dynamic relationships in flux	Shifting landscape of professional development and school improvement policies – including teaching school and maths hub interconnections Influenced by global policy movements – mastery as a transnational policy. Movement of the initial Shanghai and mastery policy to the activity of multiple actors
Assemblage as a process of labour and agency	Creation of some mastery actors and reassemblage of others in response to the mastery policy The production of replication, isomorphism, and network affinities

The mastery state-market assemblage: features summarised

The rearticulation of the state and the reallocation of tasks to other actors, as noted earlier, has been long recognised and theorised and is indicative of the increasing complexity of government (Ball 2009). However, more recently, in relation to teacher professional development at least, there has been in England a move towards greater central direction. Our view is that this move is a strengthening of a centralising tendency long intertwined with marketisation (Brown 2015). Understanding the mastery policy and its related actors as assemblage indicates that the market is far from free; it has multiple logics linking the market and state direction. We contend that within the discourse of marketisation and of school and teacher autonomy, there has also been a contradictory process of centralisation operating to direct professional learning opportunities.

Across the mastery market, the three more ontological features, from Baker and McGuirk's commitments, are apparent, summarised in Table 2.

The fourth commitment – embracing uncertainty and provisionality and rejecting fixed explanations – is not a feature of the mastery market as such. Rather, as pointed out earlier, this is an epistemological and methodological commitment. Consequently, we put forward our analysis of the mastery market as provisional.

Conclusion

There are longstanding analyses of the ongoing privatisation of public education. These have been extended to professional development through concepts such as the shadow state. We have built on these accounts by examining one area of professional development in detail using the concept of assemblage to identify the multiple and conflicting roles that actors play and their multi-faceted involvements as private enactors of education policy.

In mastery professional learning, marketisation and competition arguably form a mirage in which network governance masks a process of state-market assemblage. Further, the transnational dimension of curriculum and pedagogical reform is evident in the role of global influences on the professional development landscape. Recognising the importance, and potential consequences, of replication,

isomorphism, and affinity relationships extends previous descriptions of the hierarchy, markets and networks and shadow state actors within the English education system.

Although focused on mathematics professional development, the analysis we have presented has wider potential for identifying the tensions and paradoxes between the state's role in England in directing education policy, and, simultaneously, adopting and promoting market discourses. Similar processes are apparent in policies such as the awarding of contracts for the *Teaching Learning and Investment Fund* (Ellis, Mansell, and Steadman 2021). More recently, the complex processes by which the government seeks to direct pedagogical practices and curriculum choices whilst appearing to manage a market have surfaced in the award of contracts for Covid 'catch up' materials, with publishers contesting the fairness of the Department for Education's (DfE) tendering processes (Mansell 2021). As a further development of this DfE has funded another potential actor in the professional development state-market assemblage – Oak National Academy – as a supplier of both curriculum materials and connected professional development which had a single shareholder – the Education government minister – but described as 'at arm's length' and independent. Similarly, the proposed changes to teacher education introduce a revised 'market' with increased central control over the teacher education curriculum – teacher education is referred to as Initial Teacher Training by the government in England (ITT Market Review Group 2021).

Arguably, in education policy research attention has been on how neoliberal ideologies and forces of markets and globalisation have played out in practice. In so far as educational ideologies are considered, this has focused on contestation between different varieties of neoliberalism, for example regarding the extent to which support for market mechanisms has been combined with new public management principles.

The development of the mastery market in England is an extension of the introduction of market mechanisms, which initially targeted school governance and choice, and now operates on curriculum, pedagogical, and professional development policy. The mastery state-market assemblage is an example of a local instance of the contradictions that are generated through neoliberal reform (Peck and Tickell 2002) – in this case in mathematics teacher professional development. It was not a pre-planned opportunity for diverse teacher professional development opportunities, but emerged as an assemblage with multiple logics, in flux and unstable. One consequence is that labour and effort that might otherwise support professional learning are mobilised in the processes of competition between various actors, thus underlining how markets can lead to inefficiency where markets divert and waste public resources. Further, this results in a potentially confusing landscape of mathematics professional development that teachers and schools must navigate, with apparent choice hiding state direction and choice in the mastery market obscuring reduced autonomy.

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