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Local learning landscapes:

exploring coherence, equity and quality in teacher professional development in England

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Foreword

The purpose of Wellcome's 5-year programme on teacher professional development was to engage a wide range of stakeholders from the policy, practice, and research communities to consider and contribute to a body of knowledge on where and how existing frameworks could be improved. This work has helped to draw attention to the importance of high-quality subject-focused professional development and learning for teachers, and the challenges involved in ensuring that all schools and all teachers can and do engage.

As part of our programme a research team based at the University of Nottingham, led by Professors Toby Greany and Andrew Noyes, used primary mathematics as a case study to understand how local learning systems operate to provide high quality inclusive professional learning for schools. Their findings are immensely important, with significant implications for education policy and practice in England. The report's themes – around coherence, equity, quality, and leadership - and the importance of considering how these play out across diverse local landscapes - resonate strongly with the other work we supported in this area. While England is certainly distinctive in how it has approached reform in recent years, I believe these findings will also have relevance for wider national and international audiences.

Nan Davies, *Head of Culture and Society Transition, Wellcome*

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About the project

This report sets out the findings from a study of 'local learning landscapes' for teacher professional development in England's primary schools. The research was supported by Wellcome (Grant Number 224008/Z/21/Z).

At the start of the project a website was launched (www.equalls.uk) and the research team has used this to share emerging insights and findings as the work has progressed.

An Advisory Group provided invaluable advice and feedback at all stages of the project:

- Nick Brook, Deputy General Secretary, National Association of Head Teachers (NAHT)
- Professor Philippa Cordingley, CEO, Centre for the Use of Research and Evidence in Education (CUREE)
- Nan Davies, Head of Culture and Society Transition, Wellcome
- Stef Edwards, CEO, LEARN Academy Trust
- Richard Gill, Chair, Teaching School Hubs Council and CEO, Arthur Terry Learning Partnership
- Matt Lewis, Chair, National Association of Mathematics Advisors (NAMA)
- Dr Rachel Marks, Principal Lecturer in Mathematics Education (Primary), University of Brighton
- Dame Alison Peacock, CEO, Chartered College of Teaching
- Judy Shaw, Headteacher, Tuel Lane Infants School
- John Westwell, Director for System Leadership, National Centre for Excellence in the Teaching of Mathematics (NCETM)

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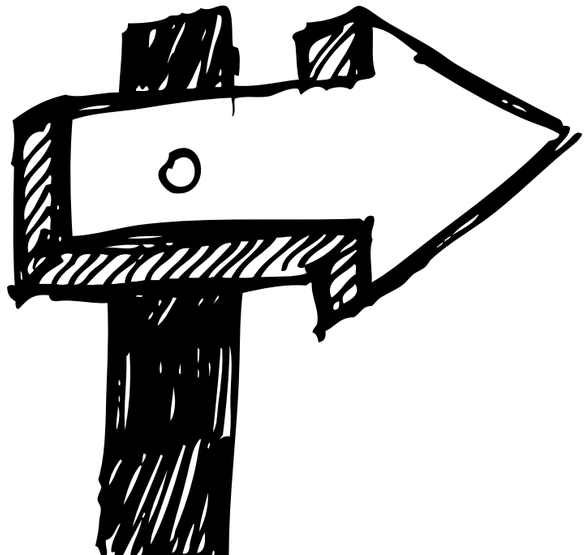

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About the research team and report authors:

Toby Greany is a Professor of Education and Convener of the Centre for Research in Education Leadership and Management (CRELM) at the University of Nottingham. His research explores how policy and practice interact to shape educational opportunities and outcomes, particularly across local systems and through networks, and the nature and role of leadership in these processes. In the past he has contributed to several studies of Continuing Professional Development and Learning (CPDL) for teachers and school leaders, including for Wellcome.

Thomas Cowhitt is a Lecturer in Collaborative Improvement at the University of Glasgow. He specialises in Social Network Analysis and data visualisation and his research involves partnering with both networks of schools (i.e., school districts in the United States, Local Authorities in Scotland, and Multi-Academy Trusts in England) and individual teacher innovators to explore the multi-dimensional nature of school improvement. The aim of his work is to inform new models for school governance and initiate new collaborative ways of working among educators in school systems.

Andrew Noyes is a Professor of Education at the University of Nottingham where he has been Head of the School of Education and APVC for Research in the Faculty of Social Sciences. Andy is Chair of the Joint Mathematical Council of the UK and a member of the Royal Society's Advisory Committee on Mathematics Education. His research interests centre on post-16 mathematics education, on change in complex systems and on educational policy. He has advised DfE on post-16 mathematics and worked with regulators in England and Scotland on qualifications reform.

Georgina Hudson is a Research Fellow at the University of Nottingham. Georgina is a member of the Centre for Research in Educational Leadership and Management and has an interest in evidence-based school improvement and leadership, and the changing role of middle leaders in schools. Georgina's previous research has explored the interplay between accountability structures and school-led research.

Catherine Gripton is an Assistant Professor at the University of Nottingham. She is a member of the Centre for Research in Mathematics Education in the School of Education and a specialist in early childhood mathematics (early years and primary). Her research seeks to further understanding of policy and practice in mathematics for young children, including contributing to national guidance and professional development materials for practitioners.

Executive Summary

To what extent, and how, do local learning landscapes in England operate to provide high quality, inclusive professional learning for primary schools?

Ensuring that all teachers engage in high-quality Continuing Professional Development and Learning (CPDL) has long been a policy priority in school systems worldwide, given evidence that this can lead to improvements in teaching quality and, thereby, children's outcomes.

In high-performing school systems globally, arrangements for CPDL are coherent and well-coordinated. However, England's school system is experiencing fragmentation and partial reformation - evolving from place-based oversight by 152 Local Authorities (LAs), to non-place-based oversight of around 1200 Multi-Academy Trusts (MATs), although large numbers of schools remain outside this framework. In terms of CPDL, the shift has been from a patchwork of school-led provision, including by around 750 Teaching Schools, to a nationally defined offer (i.e. the Early Career Framework and National Professional Qualifications) provided by 87 Teaching School Hubs (TSHs) and augmented by a range of other curriculum hubs and commercial providers.

In this context, this research asks: "To what extent, and how, do local learning landscapes in England operate to provide high quality, inclusive professional learning for primary schools?" The research focused on formal and informal professional learning in mathematics, using this as a lens onto wider CPDL practices. Three localities were selected for study, each within an LA area encompassing around 100 primary schools. In each locality, a representative sample of local system leaders and school-based staff (heads, maths leads and class teachers) were interviewed. The three localities were:

- City (a sub-section of a larger city) is significantly deprived, though with some more gentrified areas, and has an ethnically diverse population.
- Town is a former industrial centre with a largely white British population. It is an area of significant deprivation but includes some less deprived suburban and semi-rural areas.
- Shire (part of a larger LA) covers a large geographic area encompassing towns, villages, hamlets and countryside. It includes some deprived post-industrial small towns as well as more affluent areas.

High-quality professional learning: what does it involve?

Interviewees were asked what they saw as high-quality professional learning. Responses were broadly consistent across different groups.

High quality CPDL:

- achieves impact - "the endpoint is always the children and young people - the endpoint is not teachers"
- is adapted to the context of the school or classroom - "it's got to meet the needs of the school, 'cause otherwise it's not going to have any impact"
- is iterative and sustained - "drip, drip, drip"
- connects to the real needs of teachers in ways that challenge thinking as well as changing practice - "it's the stuff you keep going back to, and that reminds you of why you're there in the first place, but also challenges you to think differently and then put those actions into place"
- involves structured collaboration - "it's the fact that there's a responsibility to come back together and sort of report back on how it's done, how it's going, or to observe each other".

Summary findings: six core features of local learning landscapes

The research was informed by four overlapping literatures (place, complexity, networks and organisational learning) from which a conceptual framework was developed identifying six features of a local learning landscape.

Local lens: There are multiple and changing versions of 'local'. Specific geographic localities lack coherence unless the professionals who work there choose to imbue it.

The 'locality' in which interviewees worked was important to their professional identities and practices. Many saw themselves working within multiple 'locals' simultaneously, for example their school community, their MAT, their town, their CPDL hub, and/or their (online) networks. There was a widespread view that geographically 'local' arrangements are becoming fragmented as LAs become less significant and as schools join different MATs. However, there were clear differences between MATs, for example in terms of size and ethos, meaning that perceptions of 'local' could differ between staff working in different MATs within the same locality.

Previously strong local clusters have commonly splintered, as schools join different MATs. MATs were widely seen to require schools to adhere to the rhythms and routines of the trust and schools did not have time to participate in parallel cluster-based activities. Several interviewees lamented the loss of such local collaboration, arguing that the schools involved were all serving the same set of children.

Many linked systems: Each local landscape is composed of multiple organisations and networks which link together more or less tightly and in more or less formal ways.

The three localities have developed quite differently in terms of how the main providers of CPDL collaborate, meaning that systems for CPDL were more and less tightly coupled.

City's approach has been relatively strategic: a core group of local system leaders have worked together to secure collaborative bids over time, enabling them to integrate different policy initiatives. The Maths Hub works closely with the Teaching School Hub, supported by several local MATs as well as the LA. These leaders work to maintain a city-wide approach to CPDL provision as far as possible.

Shire's approach is more networked: local leaders have created an independent, subscription-based network of local headteachers, chaired by a retired headteacher. This network leader sits on the boards of the Maths Hub and Teaching School Hub, both based outside the local area. They then connect schools to CPDL providers, bringing a level of cohesion to the local learning landscape.

The landscape in Town is more fragmented, even balkanized. The roll back of a previously dominant LA, the ending of central government funding for local CPDL offers, the closure of an influential Teaching School and the absence of any strong locality-wide partnership arrangement has led to a weakly-coupled system. Meanwhile, schools that have joined non-local MATs have been required to sever existing links with the Maths Hub.

Two salient factors influence local coupling: the geographic proximity of providers and local MAT dynamics. Geographic proximity includes the location of hubs: in City, the Maths and Teaching School Hubs are based in schools in the city, while in Town and Shire they are based elsewhere. MAT dynamics had several aspects: 1) the geographic locus of the MATs (i.e. local/non-local), 2) school performance and levels of concern around MAT expansion/take over (in particular where the hub was operated by a MAT), 3) MAT ethos (i.e. more or less standardised) and 4) the extent to which MATs (are seen to) collaborate with each other and with the LA.

Professional learning: Individual teachers engage in formal and informal learning.

Combinations of formal and informal professional learning throughout their careers had helped teacher respondents to become confident, often enthusiastic, teachers of mathematics, sometimes despite not having enjoyed the subject at school themselves. A minority described specific courses or experts that had influenced their thinking and practice, but most professional learning was incremental, involving combinations of 'learning on the job' with more intentional development activities that had varying degrees of formality.

Headteachers and maths leads play a key role in shaping how CPDL operates and aligns with wider school improvement processes, tools and routines. It is rare for non-maths-specialist teachers and teaching assistants to attend external training in mathematics. More common was for the maths lead to attend external events and to then cascade to colleagues via periodic INSET sessions.

Maths Hubs played a role in providing CPDL in all three localities, but levels of school and MAT engagement varied. Among schools that engaged, this provision was well regarded and maths leads had access to a wider range of professional development opportunities than in non-engaged schools, although some larger, non-engaged MATs had the capacity to offer a significant program as well.

Practices, tools and routines: Where professionals share practices, tools and routines, this can facilitate individual and collective learning.

Mastery was interpreted differently, but tended to include: 1) reduced within-class differentiation, 2) more teacher-led instruction, 3) the use of manipulatives, and 4) an emphasis on reasoning alongside procedural fluency.

Individual schools and MATs were working to develop internal consistency in how mastery was developed in the classroom, drawing on selected practices, tools and routines. For example, most had adopted a mathematics scheme, such as White Rose, as a scaffold for mastery teaching, although teachers adhered to these more and less closely.

Schools and trusts generally adopted one of two broad approaches to developing consistency: a tightly structured and prescribed top-down model, or a more emergent approach that relied on collaborative planning and professional autonomy. Each approach was reflected in a distinctive CPDL model: the former relying on codified materials and formal training backed by performance management processes, while the latter relied on subject networks, development projects and routines such as lesson study.

As schools and trusts developed different interpretations of mastery and models for strengthening consistency the scope for collaboration and learning across local areas had become more challenging.

Bridging boundaries: Some individuals operate beyond their immediate organisation or context, helping to move knowledge and expertise around the locality.

Individual teachers and leaders who look beyond their immediate organizational contexts play a key role in moving knowledge around. Headteachers and subject leaders span boundaries as part of their formal roles, but there were clear differences in how these leaders operated. Some were outward looking, well-networked, and focused on connecting their staff to external evidence and expertise. Others were less active in these areas, either because they did not see it as a priority or because of real or perceived barriers to external collaboration and practice sharing.

These school-based approaches were influenced by the local learning landscape. For example, in Shire headteachers trusted the chair of the headteacher association to disseminate relevant CPDL opportunities, whereas in City and Town there was a need to be more active in seeking out opportunities. All three Maths Hubs had identified local leaders of mathematics education, expert middle and senior leaders based in schools who contributed to the Hubs' work.

Sense making: Relevant leaders come together periodically to identify and tackle shared issues, taking time to explore underlying causes and to shape collaborative action.

Most schools provided opportunities for (some) staff to reflect, collectively, on the progress they had made, the challenges they faced, and the steps required to address emerging issues. At locality level there was evidence that individual MATs and, to some extent, wider localities, were engaged in a level of 'bottom up' sense making. For example, by running headteacher conferences and facilitating networks for maths leads.

However, there was little evidence of strategic, ongoing sense making in relation to maths pedagogy, practice and/or CPDL across the localities. Some fora did exist for bringing key leaders together, for example through Hub advisory groups or LA-convened improvement partnerships, but no clear body had responsibility for making sense of patterns of pupil attainment across a locality, or for identifying shared CPDL needs for staff across different schools.

Discussion: understanding local learning landscapes

Coherence of professional learning
In simple terms, coherence might be seen as a 'well-coordinated' and clear CPDL offer that all schools can access. However, the research revealed a more nuanced set of conditions for coherence to be experienced, including coherence across subject-knowledge and pedagogical practice, coherence with intrinsic forms of personal and professional growth, and coherence throughout a career.

A clear finding is that the CPDL offer across all three localities is generally experienced as fragmented - or incoherent - but the level and nature of this incoherence differed widely. These differences can partly be understood in relation to the distinctive history and context of each locality, but also in how local leaders have enacted national policies. Shire's headteacher network relies on trust and established allegiances, through which it works to incorporate the new, non-local hub structures. In City, coherence has developed through collaboration across leading hub organisations, backed by local MATs, the LA and other networks. Town is essentially balkanized, with several border-crossing MATs driving their own distinctive versions of internal coherence, while rapidly dissolving LA systems and the loss of a well-regarded Teaching School Alliance - TSA have left a vacuum for schools outside these MATs.

The extent to which these varied attempts at coherence are 'working' is moot. City's model is complex and multi-level, dominated by a few established players, while a minority of schools have chosen not to engage with the Maths Hub. Shire's partnership structure is inclusive, with less risk of school isolation, but it is mainly focused on information-sharing and remains fragile, dependent on membership funding and the leadership of its respected chair. Schools within MATs in Town may be well-served but many schools are not and the lack of locality wide alignment across providers creates serious risks of knowledge silos.

Quality of professional learning
There are points of similarity as well as variations in how CPDL operates across different schools, MATs and localities. The most consistent similarity was the role of the maths lead in cascading learning within schools. The level of support provided to these maths leads varied, depending on their headteacher, the size of the school, whether or not they worked within a MAT that employs a mathematics specialist, their access to local peer networks and so on.

School size and MAT membership partly explained differences in how CPDL was structured and experienced, but these features did not determine CPDL quality. Some small schools had rich professional learning cultures while some large schools had approaches that appeared narrow or formulaic.

Coherence and quality in CPDL is about more than whether high quality courses are available and signposted to schools. Such courses only achieve impact if all schools engage and if all schools can embed the learning in ways that support continuous improvement. This leads to an unsurprising conclusion that a key determinant of CPDL quality is the quality of school leadership. But this leadership requires far more than an internal focus on instructional issues; it is equally dependent on leaders being outward looking and demanding commissioners of CPDL.

Such outward facing leadership is clearly influenced by the wider structures and cultures within which leaders operate. None of the three localities has this cracked. Shire is arguably more inclusive but its local network can also be seen as an attempt to limit the influence of external CPDL providers, meaning that it lacks the vibrancy and flows of ideas apparent in City, while Town risks becoming ever more balkanized if the hubs cannot engage key MATs.

Equity and professional learning
The government's investment in hubs and the 'golden thread' is an attempt to ensure equality in the CPDL offer. The research revealed numerous examples of how this investment is helping to ensure that teachers and schools access CPDL, including many in deprived and/or remote contexts. Nevertheless, the research also revealed stark inequalities - a postcode lottery - between schools and between the three localities in terms of access and engagement with CPDL.

Maths Hubs, and equivalent policy-designated hub providers, offer extensive opportunities for teacher learning, but this strategy has limitations. In part this relates to the flexibility of the model and the sheer size of the Maths Hub footprints compared to the resources available. Ultimately, though, school and MAT leaders can choose whether or not to engage with a hub. Significant proportions choose not to engage, whether because of lack of awareness, perceptions that Hub provision is "not right for us", that mathematics is not currently a CPDL priority, or lack of capacity. Meanwhile, several larger MATs in the study were selling courses externally, often building on a hub designation and using this to generate significant income, creating further systemic inequalities.

Locality leadership for professional learning
The research identified a small number of system leaders who are influential in shaping the local CPDL landscape – the landscape gardeners. These leaders did not hold consistent designations or defined roles and, from the outside, could appear relatively invisible. Some played senior roles in hubs and MATs, sometimes combining this with school-based remits, while the chair of the heads association in Shire was an example of a more overarching role. These leaders worked to shape a distinct local identity, acting as bridgers and brokers across boundaries, as network builders, and as knowledge mobilisers. All had built their professional capital over many years working in their particular locality, so while their skills might be relatively generic, it would be hard to transplant them elsewhere. Concerningly, the loss of one such leader from Town, who left to work elsewhere when the Teaching School was de-designated, was seen by many as a key factor in the subsequent fragmentation of the local CPDL landscape.

"A clear finding is that the CPDL offer across all three localities is generally experienced as fragmented - or incoherent - but the level and nature of this incoherence differed widely.

Conclusion and implications

As we note above, a clear finding from this research is that the local CPDL offer is experienced as fragmented by most primary schools. However, the level and nature of this incoherence differed widely between the three localities, with important implications for quality and equity. Our findings suggest that recent policy-driven efforts to reform the CPDL framework, aiming to ensure national consistency and coverage, will not succeed unless attention is paid to the nature and implications of diverse local learning landscapes.

Drawing out specific recommendations is challenging given the complexity of the issues, and there are limits to what can be inferred from a study of primary mathematics CPDL in three localities. Nevertheless, four questions emerge, with associated implications for coherence, quality and equity.

How can headteachers and subject leaders be supported to become more outward facing in their approach to CPDL?

The research highlighted the importance of maths leads and headteachers being outward-facing, well-networked 'boundary spanners' who access relevant external knowledge and expertise and use this to enrich the professional learning of colleagues within their school. However, the extent to which this happened differed widely.

This indicates a need to strengthen support for outward facing leadership, for example by including locality examples in the new Leading Teacher Development NPQ and by establishing an expectation that primary subject leaders should have access to local curriculum networks.

How can the roles played by local CPDL system leaders be recognised, rewarded and strengthened?

The research highlighted the role played by a small and somewhat disparate group of local CPDL system leaders – the landscape gardeners.

Current system leadership policy focuses almost exclusively on MAT CEOs, who are highly paid and have access to various forms of CPDL. Local CPDL system leaders arguably require equivalent recognition and support across every locality in England.

How should curriculum hubs integrate with MATs?

Hubs currently provide a 'horizontal' CPDL offer which is free, local and universal. Meanwhile, MATs have a 'vertical' responsibility to secure CPDL across the schools they operate.

If the aim is for a national CPDL entitlement and strong local learning landscapes, then there should be clear expectations for all MATs to engage with their local hubs and with other local trusts. Conversely, if MATs are seen to be self-sufficient 'vertical' CPDL silos, then hubs could perhaps be given a remit to focus on engaging the many schools that are not in trusts (although this would not address the balkanisation issue).

A related issue is who should operate the hubs, given the finding that MAT-run hubs can create unfortunate local dynamics. We note that in some subjects, hubs and networks have emerged across wider organisations, such as universities and museums. Whatever the model, there is a need for significant and sustained investment if hubs are to achieve meaningful impact.

Who, if anyone, could or should have responsibility for the coherence of CPDL across a locality?

A more concerted focus on ways to strengthen local learning landscapes is needed. England's current framework is at odds with the approach in high performing systems worldwide.

However, we found little agreement on how local CPDL landscapes 'should' be developed, even among policy makers and experienced system leaders. One view might be that all schools should join a 'strong' MAT, but this would not address the risks associated with balkanization and knowledge silos. A second option might be to rationalize the landscape, for example by co-locating the various hubs into singular sub-regional bodies, but this would risk disrupting the existing subject-specific networks and sources of expertise that have developed. A third view might be that the existing reforms simply need more time to bed in, but the evidence presented here of divergent local dynamics and significant equity and quality issues makes this seem unlikely.

Ultimately, it may be that local coherence in CPDL will be dependent on a wider set of changes in the governance of local schooling arrangements. For example, could locality partnerships be developed in all areas, building on existing examples such as Camden Learning, Learn Sheffield and Surrey's SAfE? Could DfE Regional Directors work with LAs to strengthen locality oversight of schooling, for example through the publication of dashboards which track key indicators in relation to the recruitment, development and retention of staff; levels of inclusion and exclusion; and school performance and pupil progress? Could Ofsted be tasked with undertaking local area inspections of CPDL provision and impact, in the way that it did previously for 14-19 provision?

Whatever the mechanisms selected, the priority should be to strengthen local CPDL coherence, quality and equity given evidence that this will enhance teacher and pupil outcomes.

Introduction

01

The problem

School systems around the world have been experiencing increasingly rapid change and reform efforts in recent decades.[1] Many governments are stepping back from hierarchical control of schools, adopting marketised and other new public management approaches as they seek to increase choice, improve quality, enhance equity and encourage innovation. One common thrust in all these approaches is to invest in support for Continuing Professional Development (CPD) and for the related professional learning which teachers take from it (CPDL), given strong evidence that this can lead to improvements in the quality of teaching and, thereby, children's outcomes.[2]

England's school system is undergoing significant changes. These processes of fragmentation and partial reformation encompass both school structures and arrangements for CPDL and have been underway for more than a decade. The end goal for the structural organisation of schools remains unclear, not least given the government's decision to abandon its proposed Schools Bill in 2022.[3] Local areas in England now combine old, new and emergent schooling arrangements, raising important questions about the strategic design, oversight and implementation of teachers' CDPL. This project explored this problem.

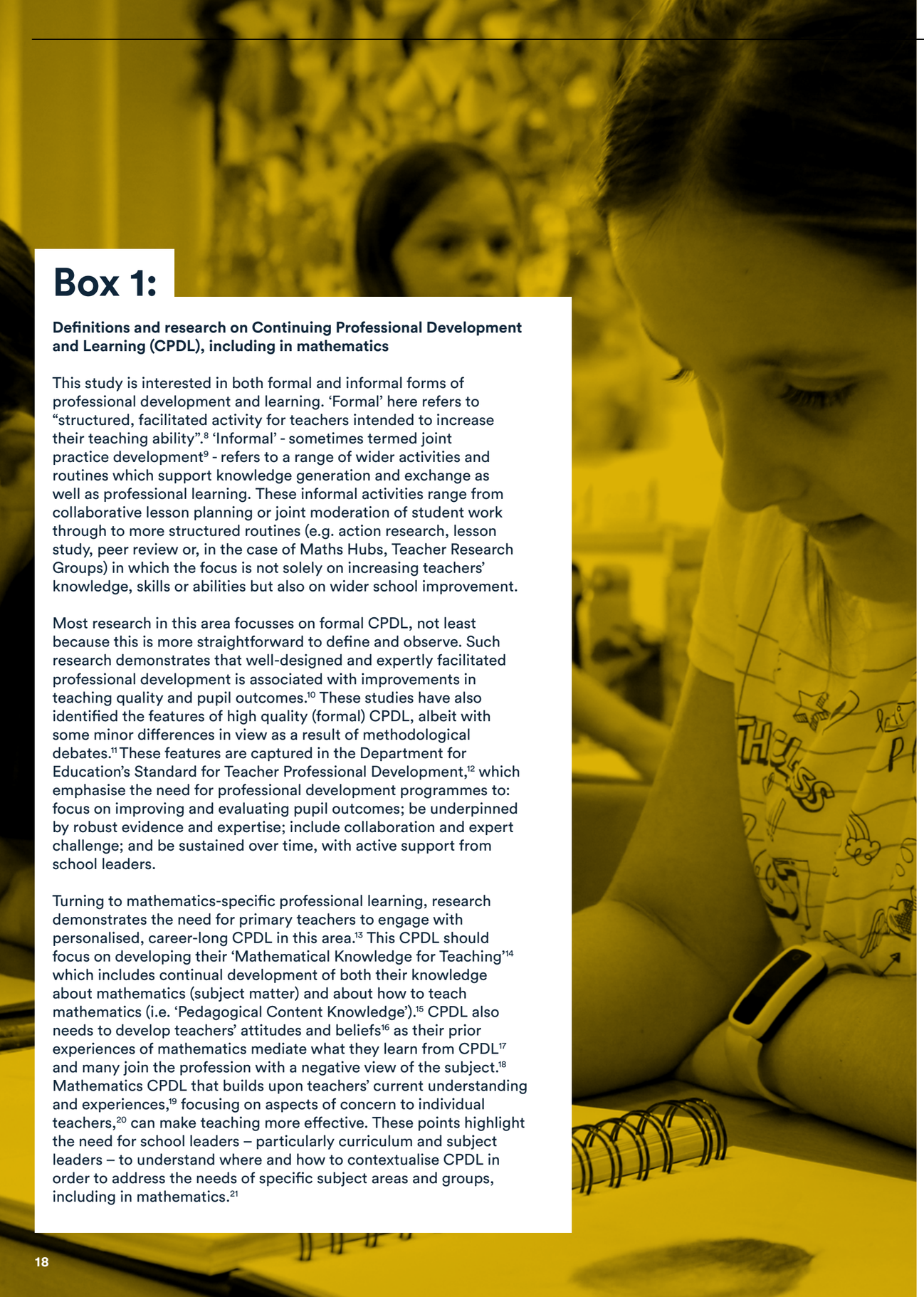
A focus for research

Box 1 (overleaf) provides definitions for CPDL and sets out key features of effective professional development based on existing research. In recent years this evidence has supported a policy focus on designing and delivering formal professional development programmes that can maximise impact.[4] A parallel focus has been on ensuring that schools and teachers implement practices that are underpinned by a rigorous evidence-base.[5] A third area of interest has been in understanding how wider school cultures and systems can facilitate – or distract from - professional learning.[6] It is important to understand how these priorities play out in England's evolving educational landscapes.

Instead of asking what professional development providers and schools 'should' do, this research project investigates what they actually do within the messy realities of everyday practice, and how this varies across different contexts. To explore this messiness, the study takes a broad view of CPDL that includes both informal and formal professional development and learning (Box 1). In addition, the research is multiscale in the sense that system leaders', school/curriculum leaders' and teachers' perspectives and actions are all considered to be important. Finally, the research seeks to understand teacher and school CPDL processes in the context of local schooling landscapes, as this will enable better understanding of issues of coherence, quality and equity in teacher professional learning.

Reflecting these interests, the core research question addressed in this report is: "To what extent, and how, do local learning landscapes in England operate to provide high quality, inclusive professional learning for primary schools?" Several specific questions relating to the leadership of local learning landscapes are also investigated and these are set out in Section 6.

It is important to recognise the significant impact of the Covid-19 pandemic on schools and the children and families they serve.[7] The research reported here was undertaken in the 2021-22 academic year, during which schools in England were 'open' (i.e. providing in-person teaching), but when rates of infection remained high among both staff and pupils. The research explored participant's experiences of CPDL arrangements both before and during Covid, but it is important to recognise how the pandemic has impacted teacher CPDL both directly (e.g. increases in on-line learning) and indirectly (e.g. influencing how schools collaborate in networks). The residual effects of this systemic upheaval, in particular in relation to teacher CPDL, remain to be seen.



Box 1:

Definitions and research on Continuing Professional Development and Learning (CPDL), including in mathematics

This study is interested in both formal and informal forms of professional development and learning. 'Formal' here refers to "structured, facilitated activity for teachers intended to increase their teaching ability".[8] 'Informal' - sometimes termed joint practice development[9] - refers to a range of wider activities and routines which support knowledge generation and exchange as well as professional learning. These informal activities range from collaborative lesson planning or joint moderation of student work through to more structured routines (e.g. action research, lesson study, peer review or, in the case of Maths Hubs, Teacher Research Groups) in which the focus is not solely on increasing teachers' knowledge, skills or abilities but also on wider school improvement.

Most research in this area focusses on formal CPDL, not least because this is more straightforward to define and observe. Such research demonstrates that well-designed and expertly facilitated professional development is associated with improvements in teaching quality and pupil outcomes.[10] These studies have also identified the features of high quality (formal) CPDL, albeit with some minor differences in view as a result of methodological debates.[11] These features are captured in the Department for Education's Standard for Teacher Professional Development,[12] which emphasise the need for professional development programmes to: focus on improving and evaluating pupil outcomes; be underpinned by robust evidence and expertise; include collaboration and expert challenge; and be sustained over time, with active support from school leaders.

Turning to mathematics-specific professional learning, research demonstrates the need for primary teachers to engage with personalised, career-long CPDL in this area.[13] This CPDL should focus on developing their 'Mathematical Knowledge for Teaching'[14] which includes continual development of both their knowledge about mathematics (subject matter) and about how to teach mathematics (i.e. 'Pedagogical Content Knowledge').[15] CPDL also needs to develop teachers' attitudes and beliefs[16] as their prior experiences of mathematics mediate what they learn from CPDL[17] and many join the profession with a negative view of the subject.[18] Mathematics CPDL that builds upon teachers' current understanding and experiences,[19] focusing on aspects of concern to individual teachers,[20] can make teaching more effective. These points highlight the need for school leaders – particularly curriculum and subject leaders – to understand where and how to contextualise CPDL in order to address the needs of specific subject areas and groups, including in mathematics.[21]

Research design

This report focuses on local learning landscapes, the choice of the landscape metaphor being deliberate (c.f. 'system' or 'model') to reflect the evolving and complex nature of school education in England. Ultimately, the research team settled on the metaphor of landscape because it captures the organic nature of place-based change, but also the potential for leadership agency which can influence how change occurs, what might be termed landscaping. As Clandinin and Connelly argued almost 30 years ago, the landscape metaphor "allows us to talk about space, place, and time…[and offers] the possibility of being filled with diverse people, things and events in different relationships".[22]

The challenge for the research design was how to make sense of evolving 'local learning landscapes' for teacher CPDL. A detailed project methodology is included in Appendix A. Three particular problems concerning the project's scope and focus needed to be addressed in the design, each reflecting a balance between sophistication and pragmatism.

Firstly, on which area of the professional learning 'landscape' should the research focus? Given the complexity of school arrangements in England, and the inclusion of both formal and informal learning, the risk was that the study would become overwhelming. The decision was made, therefore, to focus on one phase (primary) and one core curriculum area (mathematics). This case – of primary mathematics CPDL – offers the potential for developing more generalised insights into CPDL processes and practices in primary schools while recognising the subject-specific nature of professional learning as noted in Box 1. As a core curriculum subject, mathematics is central to the work of all primary schools and, importantly, was the first subject for which the Department for Education (DfE) established a hub model for professional development.[a] This national framework for facilitating mathematics CPDL is complemented by a wider offer from multiple sources, as discussed in Sections 5 and 6.

[a] Maths Hubs were established in 2014, coordinated by the National Centre for Excellence in Teaching Mathematics (NCETM).

The second problem concerned definitions of local, and whether a small sample of locals could meaningfully represent the diversity of school types and arrangements in England. Informed by the project's Advisory Group, three localities were selected from the south, midlands and north of England. One is within a city, another is a town, and the third - shire - includes a mix of rural villages and more densely populated centres (see Table 1.1). Each locality sits within an LA area encompassing around 100 primary schools, making them smaller than a Maths Hub region. In each locality six or seven schools/academies were visited, sampled to reflect a representative range of contexts (e.g. levels of Free School Meals) and school arrangements (academy/maintained), performance levels (e.g. Ofsted grade) and levels of engagement with the Maths Hub. Section 4 includes an overview of the three localities.

The third design problem concerned the range and combination of stakeholders who would need to be interviewed in order to understand these local landscapes. Different stakeholders have different perspectives and so a range of 'system leaders' were interviewed, 6-8 in each locality. Depending upon availability, these included Maths Hub and Teaching School Hub leads, LA leaders, Ofsted regional directors, Regional Schools Commissioners, Research School Leads and leaders of former teaching schools. In each school the head teacher, the maths subject leader, and one classroom teacher were interviewed. In total, we interviewed 82 people across the three localities. In addition, towards the end of the project, the interviewees in each area were invited to attend a locality workshop at which the emerging findings were presented and discussed.

Table 1.1: Locality Comparison

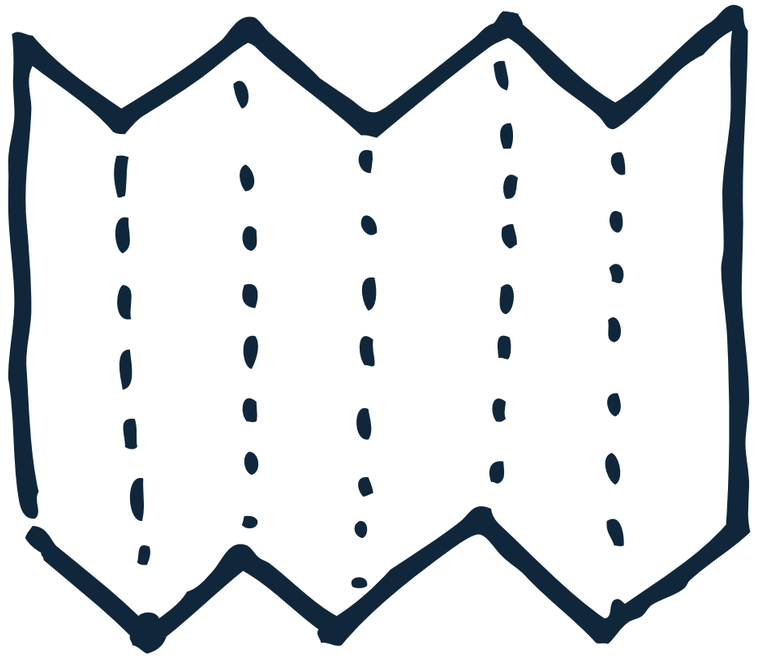
	City	Town	Shire
Urban/Rural	Urban	Urban/suburban	Towns, villages, hamlets, rural farmland
Boundaries	Loosely bounded set of neighbourhoods within a city	Bounded- a Local Authority	Nested- multiple sub-localities within a larger county
Deprivation	Mostly deprived, some gentrification	Significant deprivation, some pockets of affluence	Pockets of deprivation, mostly affluent
Diversity	Ethnically diverse	Above average white British	Above average white British
School Density	Dense school landscape	Mostly dense school landscape	Mostly sparse school landscape
Maths Hub	Maths Hub based in locality	Maths Hub not based in locality	Maths Hub not based in locality

Report structure

Section 2 sets out the background to the research, outlining recent developments in policy and practice in this area, both internationally and in England. It explores why CPDL coherence, quality and equity are particularly challenging in England's complex and evolving school system and provides a summary of approaches to CPDL in mathematics.

Section 3 provides an overview of the four bodies of literature that have informed the study – place, networks, complexity and organisational learning – and then sets out six theoretically salient features of a local learning landscape which together represent the project's conceptual framework.

Section 4 describes the three localities and provides an overview of the local learning landscape in each one. **Sections 5 and 6** analyse the findings in more depth: **Section 5** explores cross cutting findings against the six core features in the conceptual framework, while **Section 6** provides a discussion of the findings in relation to four overarching themes (coherence, equity, quality and leadership). Finally, the conclusion draws out the significance of the study and considers key implications for policy, practice and research.



Background

02

This section provides an overview of how recent developments in England have shaped schooling landscapes and the types of CPDL available to schools. It starts with a brief overview of evidence from education systems globally that highlights the importance of coherence in how schools and teachers are supported to develop, including through arrangements for CPDL. Key developments in education in England since 2010 are then outlined, showing that the school system is experiencing an ongoing process of fragmentation and partial reformation, which in turn has implications for teacher CPDL. Existing research into how schools and localities in England have begun to respond to these changes is explored. Finally, a brief review of policy and practice in relation to CPDL for mathematics is provided.

Coherence, quality and equity in complex and evolving school systems

Studies of high performing, high equity school systems globally highlight the importance of coherence, or alignment, across different levels and aspects of a school system.[23] This coherence is seen as essential if all schools are to have the capacity, skills and support required for success, but it can be challenging to achieve and sustain across large, complex and evolving systems.

Singapore is one school system that has managed the transition to high quality and high equity education successfully, achieving sustained high performance in international tests.[24] A key factor in this success has been coherence in the ways that policy and practice have been developed, without preventing sustained and dynamic change.[25] Since the late 1990s, policies in Singapore have sought to move away from top-down, standardized approaches and to encourage greater creativity and student-centred pedagogies, encapsulated in the Thinking Skills Learning Nation (TSLN) and Teach Less Learn More (TLLM) agendas. The resulting approach is characterized in terms of 'centralised-decentralisation', involving a combination of tight central prescription over aspects such as the curriculum and required pupil outcomes, together with a looser level of control over how schools operate to achieve these outcomes.

Although schools in Singapore have been granted significant autonomy, the coherence of the wider system for CPDL and support has been maintained. For example, since 1997 schools have been organized into four geographical zones, with seven to nine clusters per zone and 10–13 schools per cluster, each one overseen by an experienced principal as cluster superintendent.[26] Meanwhile, the Academy of Singapore Teachers (AST) works 'to build a teacher-led culture of professional learning and excellence'[27], including through the facilitation of professional learning communities (PLCs) within individual schools and networked learning communities (NLCs) across schools.

Clive Dimmock and Cheng Yong Tan researched how Singapore ensures coherent support for school leadership, showing how seven approaches work in concert.[28] These are: the creation of a leadership track as one of three career paths; an appraisal system that rewards leaders conforming to specified criteria; a consensus view of the currently estimated potential of leaders at all levels; leadership preparation and development programmes provided by the National Institute of Education; the rotation of senior school leaders, especially principals; the cluster structure and superintendent role that recognizes and promotes those with leadership talent; and last, Ministry of Education robustness in exhorting and explicating the values underlying its policies and leadership per se.

Singapore's example shows how thoughtfully designed central policies can support both school autonomy and a coherent framework for CPDL. This requires close attention to the 'middle tier' that operates between individual schools and central governments, particularly in large systems, such as England, where schools have been granted high levels of autonomy. In these contexts, existing hierarchical middle tier structures, such as LAs and school districts, have been squeezed and reshaped as individual schools and central authorities have taken on greater responsibilities, including for CPDL.[29] New commercial and voluntary sector providers commonly emerge to address school needs, while central governments frequently commission or provide CPDL programmes aimed at addressing specific policy priorities. The resulting marketplace might offer greater choice and innovation, but it also presents challenges for coherence, equity and quality, for example if certain schools do not engage or if some local areas are not well served.[30]

One recent review of evidence on the middle tier in high performing, high equity school systems identified the need to address five areas in tandem: alignment (aka coherence); subsidiarity; collaborative learning; shared moral purpose; and a whole-system focus.[31] Another study of high performing districts in the US highlighted that middle tier coherence can be achieved in different ways, from highly centralized, to highly decentralised.[32] What is clear is that coherence is important if all schools and all localities are to achieve success but, as we explore in the next section, this is challenging in England where LAs have been rolled back and a variety of school-based hubs and commercial and voluntary sector providers have emerged to provide CPDL.

Fragmentation and reformation in England's schooling structures

Following the 1988 Education Reform Act, England's 21,000 schools were relatively autonomous but operated within a place-based governance framework centered on 152 LAs. Although varied in size and the communities they served, these LAs fulfilled a relatively consistent middle tier governance role by providing challenge and support to schools and by helping to integrate new national policies while addressing locally defined priorities, including through the provision of CPDL.[33] Meanwhile, schools were variously encouraged to collaborate and compete, leading to claims that they were engaged in 'co-opetition'.[34]

The election of Conservative-led governments since 2010 has seen wide-ranging changes to this framework, in pursuit of what the government has called a 'self-improving, school-led system.'[35] These changes included a new, so-called 'knowledge-rich' national curriculum linked to more demanding national tests and exams, with important implications for the kinds of CPDL required.

The most significant structural development has been the expansion of academy schools, enabled by the passage of the Academies Act in 2010. Academies are non-profit companies that are funded and overseen by national rather than local government, so their expansion has led to a significant reduction in the capacity and role of LAs and an increase in the role of the central Department for Education (DfE). Over a decade on, more than a third of all primary schools and four in five secondary schools have become academies. These academies can operate as single stand-alone schools, but most are part of a Multi-Academy Trust (MAT). There are currently more than 1200 MATs in England, operating anywhere between two and 50+ academies within a single organizational structure overseen by a board and Chief Executive.[36] Policy and practice in relation to MATs have developed haphazardly and organically, leading to significant variation between trusts in terms of their size, composition, and geographic footprints.[37] Following the high profile failure of some large national trusts in the early years of academisation, the government moved to encourage the development of smaller and more geographically focused MATs. By 2022, the average size of trusts was seven schools, with most small and medium-sized trusts operating in just one of England's nine (admittedly very large) regions, although two thirds of large MATs (20+ schools) operate across two or three regions.[38]

Importantly, given this study's focus on local schooling landscapes, policy makers are working to avoid local monopolies (i.e. one MAT operating all the schools in one locality) which are seen to be not in the interest of parents.[39] In March 2022, the government published a White Paper setting out plans for every school to join a 'strong' MAT by 2030, but planned legislation has since been abandoned, making it unlikely that this aim will be achieved.

A number of studies have explored how MATs grow and operate and their impact on school and pupil performance, revealing a mixed picture.[40] What is clear is that MAT leaders work to create internally coherent and consistent approaches to CPDL within each trust, because this supports wider efforts to generate a shared culture and aligned practices across member schools.[41] The implication is that once a school joins a MAT, its staff will be encouraged or required to focus on the priorities and ways of the working of the trust, including by participating in trust-approved CPDL. This raises the question of whether the move to greater coherence within MATs will lead to greater incoherence between them, making local collaboration and knowledge exchange between schools that are in different MATs more difficult.[42]

It is clear that the schooling landscape in England now reflects complex geographies in which the old, place-based LAs are imbricated with newer non-place-based governance in the form of MATs. However, this remains a mixed system and the process of reformation remains partial at best. For example, around 1,300 stand-alone academies are not in a MAT and almost 12,000 schools (mainly primaries) are still maintained by their LA. A single locality is thus likely to include multiple MATs, stand-alone academies, and traditional LA-operated schools. Even the DfE acknowledges that this situation is 'messy and often confusing.'[43] For example, one implication is that secondary schools and their feeder primaries might be operating in entirely different structural arrangements, raising questions about who coordinates on behalf of all learners.

Fragmentation and reformation in teacher education and CPDL

Just as school structures have seen fragmentation and partial reformation since 2010, the same is true of policy and practice relating to CPDL, with a move from a patchwork of 'school-led' provision to a nationally defined career-long framework delivered via a range of approved providers and hub networks. This creates an interesting dynamic for formal policy-approved CPDL provision at local levels: there is both a push for vertical integration, through 1200 MATs, and a simultaneous push for lateral integration through the various hubs.

In the years after 2010, in line with the emphasis on 'school-led' development, designated system leader schools were given a role in providing CPDL and improvement support to other schools, thereby plugging gaps in provision left by the roll-back of LAs. The initial focus was on Teaching Schools, announced in the 2010 White Paper. High performing schools could volunteer to be designated by the government as a Teaching School, responsible for coordinating a network of partner schools; a Teaching School Alliance (TSA). Designation brought a remit to provide Initial Teacher Training (ITT),[44] school-to-school support for schools facing challenges, and ongoing professional and leadership development for staff across the TSA. The Teaching School received some core funding and could bid for central grants to support the delivery of various policy priorities, but was also expected to generate its own income, by selling services to other schools.[45]

> To what extent, and how, do local learning landscapes in England operate to provide high quality, inclusive professional learning for primary schools?

By 2019 there were 750 Teaching Schools in operation nationally, but these high performing schools tended to be clustered in cities and concerns were raised around 'cold spots' across the country, where school-led provision was weak or non-existent.[46] One policy response has been to try to integrate national initiatives and address capacity concerns in these 'cold spot' areas, by classifying them as Opportunity Areas and Educational Investment Areas.[47] Another response, at least initially, was to commission trusted commercial and voluntary sector providers to deliver CPDL on a national or targeted basis, for example through the Teaching and Learning Innovation Fund.[48] Meanwhile, a range of commercial and other providers - including high performing schools - has continued to offer an array of CPDL opportunities for schools and teachers. However, research consistently shows that rural and remote areas of the country are poorly served, and that schools which could benefit most from CPDL are often less likely to engage for reasons of cost and capacity.[49]

In the hope of establishing greater coherence, policy makers have sought to define and implement a national framework for CPDL. The goal is to establish an evidence-based, career-long 'golden thread' from the Early Career Framework (ECF) to a revamped suite of National Professional Qualifications (NPQs).[50] This framework aims to ensure national coverage by replacing the patchwork of TSAs with a smaller number of Teaching School Hubs (TSH). 87 TSHs have been operating since 2021, based in high performing schools and MATs, each responsible for delivery across a defined geographic area. Significantly, the remit of these Hubs does not include the provision of locally responsive CPDL.

Meanwhile, a range of other curriculum hubs have been created to address specific ministerial priorities. The first of these was the Maths Hub network (Box 2), which began with 32 school-led hubs in 2014 and increased to 40 hubs over time. Various other hubs have followed (English Hubs in 2018 (n=34), Computing Hubs in 2019 (n=34) and Behaviour Hubs in 2020 (n=22)), while the Education Endowment Foundation's (EEF) network of Research Schools has developed in parallel.[51] Other curriculum subjects are also served through hubs, such as the 28 school-led Science Learning Partnerships supported by STEM Learning,[52] while several universities, museums and other bodies run local subject networks and CPDL programmes. Each of these models has its own criteria, geographic footprints, and funding and performance management approaches, with no clear mechanisms for coordinating the work of different hubs at regional or local level.

This overview shows how policymakers are trying to address the fragmentation of CPDL provision following the roll-back of LAs. Initially, the emphasis on was on facilitating bottom-up emergence, led by designated Teaching Schools. Over time this has shifted towards central direction and a national, evidence-based offer - the 'golden thread'. As yet, these developments have not been comprehensively evaluated.

Box 2:

Evolving approaches to CPDL in primary mathematics

Before 2010, centralised, national approaches to school improvement and CPDL sought to ensure consistency in mathematics education. In the years after 2010, Conservative-led governments have sought to introduce 'mastery' approaches from high performing jurisdictions. In line with the wider changes described here, the approach was initially 'school-led', with Maths Hubs given considerable flexibility. More recently, this has shifted towards a nationally defined approach.

New Labour's national strategies rolled out national solutions via LAs, with mathematics as a priority area, in particular for non-specialist primary teachers. The 1999 National Numeracy Strategy was a coordinated, multi-level national programme of funded CPDL using centrally developed materials for school leaders, mathematics leads and class teachers (coordinated by government trained local LA mathematics advisors). The programme proved effective at changing primary teacher attitudes towards mathematics, but the CPDL model proved insufficiently flexible and expertise became diluted as it was cascaded from national, to local, to school levels.[53] Following initial improvements in performance in mathematics test outcomes, these began to plateau after 2003, following which the model was adapted into the primary framework for literacy and mathematics.

The Coalition government, elected in 2010, drew on mathematics practices in high-performing jurisdictions to inform its revised 2014 National Curriculum.[54] A focus on 'mastery', largely influenced by East-Asian mathematics teaching, emerged as 'Teaching for Mastery' (TfM), led by the National Centre for Excellence in the Teaching of Mathematics (NCETM). NCETM's role was to train mastery specialists, support these specialists to develop TfM in schools, encourage take up of textbooks, coordinate teacher exchanges between China and England and produce CPDL materials. The government created a new national network of 32 (now 40) Maths Hubs, operated by designated lead schools and coordinated by NCETM. Initially, reflecting the 'school-led' ethos of the time, schools could choose which Maths Hub they wanted to access and the CPDL offer from hubs was varied. As policy moved away from local solutions, regional responsibilities were formalised so that each hub worked exclusively with schools in its designated region. There was a move to nationally agreed programmes, with only a small amount of innovation funding for locally designed projects. Essentially Hubs are now place-based, with footprints that typically encompass around 500 schools. These schools can choose whether or not to engage with their local Maths Hub.[55]

Maths Hubs are not monopoly providers, with a range of other players in this space offering different interpretations of 'mastery' and associated CPDL offers. New textbooks were trialed with government support, with Maths No Problem and Power Maths now offered as match-funded purchases through Maths Hubs. New providers of CPDL and maths teaching resources also emerged, in some cases spun out by entrepreneurial Maths Hubs, with White Rose Maths probably the most-widely accessed. Each of these schemes interpret 'mastery' differently, potentially creating fragmentation in primary practices.

Recent policy has begun to push a more consistent national approach. The 2020 publication of national, non-statutory guidance for primary mathematics and 2022 appointment of Oak National Academy as the arms-length curriculum body for England marks a potential shift away from locally determined to national approaches to primary mathematics teaching, although use of Oak materials remains optional.[56]

Implications for local school and CPDL landscapes

The broad thrust of policy reforms since 2010 can be characterised in terms of system fragmentation and partial reformation, at the level of both school structures and provision for CPDL. At the structural level, the system is shifting from place-based oversight by LAs, to non-place-based oversight by MATs, although large numbers of schools remain outside this framework. For CPDL, the shift has been from a patchwork of school-led provision, to a more coherent national framework delivered by approved providers and hubs, augmented by a range of commercial providers. In reality these two developments overlap: for example, most MATs provide their own CPDL, while most hubs are operated by schools in MATs. One implication of these changes relates to scale. England's 152 LAs continue to maintain some schools and to hold responsibility for various aspects of educational provision, but the middle tier now includes numerous additional layers and roles, such as nine DfE Regional Directors (who oversee academies and MATs) and the various hubs described above.

As yet, there is little clarity on how these shifts are playing out in practice. One reason for this is the fact that policy itself remains fragmented, with different initiatives pushing in different directions at different points in time. For example, some areas – but not others - have been encouraged to develop a place-based approach through the Opportunity Area and Education Investment Area programs. Similarly, policy has been more nationally prescriptive in some areas than others, reflecting ministerial preferences and priorities. For example, all primary schools are required to adopt approved phonics schemes, but in other areas of the curriculum they have more choice.

Relatively few empirical studies have explored how schools and local areas are responding to the changes described here.[57] Overall, three factors appear to influence local responses to change: the history of relationships between schools and with the LA; the context of individual schools; and the agency of local actors.[58] In practice, responses vary widely, reflecting the accumulated actions and logics of multiple players in each locality together with significant contextual differences between localities, for example in levels of deprivation and differing rates of academisation. One example of the differences between localities is the fact that area-based improvement partnerships – such as Camden Learning, Learn Sheffield and Surrey's SAfE - have emerged in some areas but not others.[59]

What seems clear is that local learning landscapes are shaped by multiple factors, including national and local policies and practices on CPDL. Local landscapes evolve over time, with layers of policy and practice becoming sedimented - and variously contorted - in contexts which themselves have unique socio-economic, and therefore educational, pasts. Certainly, traditional LA-defined 'locals' are experiencing kaleidoscopic transformations. Middle-tier strategic leadership is now located in a range of place-based and non-place-based structures and networks, many of which overlap. School autonomy interacts with centrally determined policies that seek to drive change and ensure coverage and coherence. MATs create a new set of vertical structures for overseeing schools, with various hubs then charged with securing lateral connections, but few mechanisms for ensuring this occurs in practice. As an innovation space, this offers opportunities for outstanding, dynamic and influential ideas, individuals and institutions to flourish, but it also leaves gaps and holes. In this transforming landscape, coherence – the characteristic that unites high performing high equity systems around the world – remains elusive, with significant implications for equity and quality in school provision.

This case – of primary mathematics CPDL – offers the potential for developing more generalised insights into CPDL processes and practices in primary schools while recognising the subject-specific nature of professional learning as noted in Box 1. As a core curriculum subject, mathematics is central to the work of all primary schools and, importantly, was the first subject for which the Department for Education (DfE) established a hub model for professional development. This national framework for facilitating mathematics CPDL is complemented by a wider offer from multiple sources, as discussed in Sections 5 and 6.

Local learning landscapes: an exploratory framework

03

The literature review focused on four overlapping areas, outlined briefly here. From this, a conceptual framework was developed identifying six key features of a local learning landscape. The six features are also shown in the infographic on page 31.

Linking place, networks, complexity and learning

Understanding place

Given the focus on local learning landscapes, the first important concept is place – also known as socio-spatial theory. At one level, a place can be understood as a geographic location with distinctive boundaries and a unique identity.[60] This notion of place has traditionally underpinned educational policy and practice, for example through the role of Local (Education) Authorities as a middle tier overseeing all schools in a given area. This notion continues today – albeit at different scales - through initiatives such as Opportunity Areas, DfE Regional Directors, and curriculum hubs with responsibility for specific geographic footprints. However, research across multiple disciplines[61] has highlighted how place can be understood as more than simply a geographic location. Places are always multi-dimensional, evolving and connected – vertically, horizontally, and through flows - to other places, ideas, things, and people. Furthermore, places both shape and are shaped by various social forces, including class, gender, race, and dis/ability. These dimensions mean that places can be considered unpredictable and messy – 'thrown together' – with no inherent coherence or identity. Section 5 explores how different interviewees had different ways of describing their 'local', helping to illustrate how a sense of place can be important but far from fixed.

Networking professionals

As outlined in Section 2, education policy in England has embraced networks as a means of encouraging a 'self-improving, school-led system'. Networks comprise relationships which allow for the exchange of material and non-material resources. Networks facilitate engagement between practitioners – in this case school leaders and teachers – who collaborate in pursuit of shared goals, including through jointly developed CPDL. However, networks can also have a 'dark side', for example if some schools are left out[62] or if expertise becomes locked within one particular network,[63] meaning they have important implications for equity. Schools in England have been encouraged or required to form and join networks, such as Teaching School Alliances, local clusters, and school to school support partnerships. As we described above, over time, policy makers have sought to formalise these partnerships into more durable network structures, in particular Multi-Academy Trusts. Critically, these networks and MATs need not be geographically focused, meaning they often span traditional place-based boundaries.

Making sense of complexity

The overlaying of networks onto places creates inherently complex landscapes for schools and school leaders to navigate. Complexity theory provides some useful conceptual tools for making sense of the local landscapes that emerge. First is the concept of emergence, the 'as-yet-unimagined',[64] which reflects the 'non-linear, unpredictable and generative'[65] ways in which complex entities respond to change. Second, feedback loops can influence complex systems; positive feedback typically generates growth, while negative feedback regulates and diminishes growth.[66] Third, the idea of many linked systems highlights how multiple networks are connected together in ways that may be more or less planned and more or less efficient.[67] Section 4 describes the three localities in this study and the different ways in which they are responding to recent policy shifts. This illustrates both the unpredictable and emergent nature of complex change as well as the ways in which leaders in Maths Hubs, MATs and other linked systems can work to maintain coherence.

Ensuring learning

Place, networks and complexity theories are useful in making sense of change, but they do not really address what makes a local landscape a *learning* landscape. In order to do this the study drew on research on epistemic communities and learning organisations.

An epistemic community provides a basis for practitioners to collaborate, even across different networks and organisational silos.[68] In an epistemic community professionals adopt shared theories, language and tools in order to construct, share, refine and apply knowledge.[69] Shared theory refers to commonly held understandings within the community: for example, teachers might share implicit theories or rules of thumb in relation to what makes for a 'good' lesson. Shared language enables professionals to communicate in ways that go beyond everyday conversation. For example, an expert teacher will use specific technical language to dissect and discuss a lesson with a novice teacher. Members of epistemic communities will also draw on shared tools, such as a curriculum scheme, lesson planning template, lesson observation rubric, or an assessment framework. As explored in Section 5, the three localities in this study differed in the extent to which they adopted shared theories, language and tools as a platform for collaboration and learning.

Finally, learning organization theory highlights the need for schools and local schooling systems to develop certain capacities in order to navigate complexity and move knowledge and expertise around.[70] First, they need boundary spanners; individuals who can provide a bridge between different organizations, networks and knowledge domains.[71] Second, there is a need for sensemaking activity; school and system leaders must work together to identify shared challenges, to reflect on existing efforts to address these issues, and to generate adaptive responses.[72]

Features of a 'local learning landscape'

Drawing on these literatures, six features of a local learning landscape are described below and shown in the infographic.[b] These are used to structure the findings from the research in Section 5.

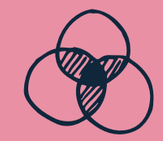
Local lens: The research focuses on specific geographic localities – City, Town and Shire – but recognises that these do not have any intrinsic coherence unless the professionals who work there choose to imbue it.

Many linked systems: Each local landscape is composed of multiple organisations and networks – such as schools, MATs, the Maths Hub and so on - which might link together more or less tightly and in more or less formal ways.

Professional learning: Individuals engage in formal and informal learning, both within their schools and through local and non-local networks as well as via formal courses and provision.

Practices, tools and routines: Where professionals share practices (including theories and language), tools and routines, this can facilitate individual and collective learning.

Bridging boundaries: Some individuals operate beyond their immediate organisation or context, helping to move knowledge and expertise around the locality.



Sense making: Relevant leaders come together periodically to identify and tackle shared issues, taking time to explore underlying causes and to shape collaborative action.

[b] The preliminary version of the conceptual framework included eight features. Following testing and refinement through the analysis, this was reduced to these six features.

Three cases of local learning landscapes

Table 4.1: Comparing City, Town and Shire

	City	Town	Shire
Local area	Main commitment is to school and (sometimes) MAT. Local cluster & city identities are weakening.	Sense of local identity and common challenges, coupled with frustration over lack of coherence.	Mixed local identities, but connections to the local remain significant for most. Some well-established and larger MATs.
Many linked systems	System leaders collaborate, including through joint bids and provision. Signposting between CPDL providers.	Many systems (some recently destabilised as schools have joined MATs), not closely linked.	Framework structures (heads network, hub boards) connect organisations through signposting and linked individuals.
Professional learning	Mainly conducted by MATs & schools. Majority of schools engage with Maths Hub.	Planned and conducted by MAT and/or school. Limited engagement with external CPDL providers, including hubs.	Opportunities vary significantly depending on size of school, MAT membership, and engagement with Maths Hub.
Practices, tools & routines	External tools are adapted to fit school/MAT. Routines & practices operate within MATs/schools, led by Maths Leads.	External tools adapted to fit school/MAT. Routines & practices operate within MAT/school, led by Maths Leads.	External tools adapted to fit school/MAT. Routines & practices operate within MAT/school, led by Maths Leads.
Bridging boundaries	Established boundary spanners link systems, with few hard boundaries.	Boundary spanners struggle to link systems, some boundary keeping.	The LA and primary heads network connect the various CPDL providers. Maths Hub work groups connect some Maths Leads.
Sense making	Limited evidence of shared sense-making across locality.	Little evidence of shared sense-making across locality.	System leaders and heads meet and engage in sensemaking. School practitioners rarely participate unless part of a MAT or Maths Hub working group.

04

This Section presents overviews of the three local learning landscapes: City, Town and Shire. These overviews seek to draw out both similarities and differences across the three cases.

City overview

Diverse urban communities – mature academy landscape (with continuing change) - established Maths Hub – mostly coordinated CPD offer – mixed school and MAT responses.

The area here called City (a central area within a larger city) is deprived, with an ethnically diverse population, although with some more gentrified areas. The schools serving the inner-city area studied face challenges that are common to most schools in deprived urban contexts. Across the LA as a whole, the proportion of children receiving Free School Meals and speaking English as an Additional Language are above national averages (see City Profile - overleaf).

One local system leader explained that "something pretty dramatic has happened" over the last 20 years in terms of school improvement across the LA, with standards in Key Stage 2 Mathematics now only slightly below the national average (see City Profile).

The local school and CPDL landscape

City has a more 'mature' academy and MAT landscape than Town or Shire. MATs have been operating here since before 2010 and all four of the case study academies visited had converted before 2015 (for details on school sample see Appendix A). Recent years have seen a more gradual process of change. The LA continues to maintain around two fifths of local schools, while 22 MATs and 11 Single Academy Trusts (SATs) operate the remainder (see City profile). There is a widespread view that the LA's role and capacity is reducing. For example, one case study school was on the cusp of joining a regional MAT, arguing that the LA had been "a bit lackluster" at bringing schools together.

A core group of local system leaders have worked together to submit 'collaborative bids' which have secured government funding and hub designations over the past decade. In this way they have worked to integrate different policy initiatives and to sustain a relatively coherent framework for formal CPDL across the city. Two regional MATs have played a dominant role in these developments, coordinating with the LA, other curriculum hubs and the research school to signpost each other's provision. Relationships between these system leaders appear mostly good, although there are sometimes tensions and there is limited evidence of more systematic efforts to identify and address shared strategic priorities for local CPDL.

The recent shift from multiple Teaching Schools (TSAs) to a single Teaching School Hub (TSH) created some issues in City. Leaders in some of the former TSAs were seen to be unwilling to 'relinquish their power'. Others argued the government's narrow remit for TSHs had left gaps in local provision, partly as a result of the decision not to let the new Hubs offer locally responsive CPDL. Interestingly, the TSH was working proactively to mitigate these issues and to circumvent policy restrictions, for example by recruiting a trusted 'boundary spanner' to work with the former TSAs and to develop a local professional development offer.

Despite efforts by system leaders to maintain this local coherence, school-based interviewees and workshop attendees commonly described the local CPDL landscape as fragmented and hard to navigate. The most common driver of this fragmentation was seen to be academisation and the growth of MATs. Experienced headteachers described how this had led to a fragmentation in CPDL provision, which would previously have been coordinated by the LA. More recently, schools in MATs were seen to have pulled away from local clusters, alliances and networks, focusing instead on working with other schools in the same trust. In the past, schools reported drawing extensively on these local networks as sources of information, expertise and support. The local clusters have not disappeared completely (indeed, one case study school was an active member of a local network made up of maintained and MAT-run schools), but there was a widespread view that they had become less vibrant and/or harder to access. The pandemic had played a part in this process, partly because schools and trusts had to focus internally during the crisis, and partly because it had accelerated a move to online networking (with a parallel drop in local connections).

The nature and impact of these trends could be observed across the City case study schools. Two were in medium-sized MATs and one in a large, regional MAT. The large MAT employs a maths specialist in its central team and has a trust-wide approach to CPDL, including subject lead groups that all schools attend. In contrast, the two medium sized MATs offered far less central support, meaning that the schools drew on other support (a consultant in one case, and the Maths Hub in the other). As noted above, one LA maintained school drew on its strong local cluster for support along with the Maths Hub. The other two case study schools, i.e. the Single Academy Trust and an LA school on the cusp of joining another MAT, explained that they felt increasingly isolated.

Maths practice and CPDL in City

The Maths Hub, which was based in an established regional MAT, was the main source of external CPDL for primary maths in City, although several schools and teachers had also drawn on other sources, including commercial companies and independent consultants. The LA no longer employed a maths specialist and so had limited knowledge of schools' needs or practice in this area, although it did support a network for school-based maths leads. In contrast, the Maths Hub was well-known and well-regarded by participants in all the case study schools. Four schools were, or had recently been, strongly engaged with the Hub, while the two 'isolated' schools had had more limited engagement. In both isolated schools, tight budgets and the challenge of releasing staff to attend external training were cited as barriers to engagement, but there were also wider factors at play as explained by one headteacher:

We didn't want to go down the Shanghai [mastery] route... there's too much change...the temptation can be to just stick with what you know and prove what you know.

The six case study schools had all strengthened their focus on the curriculum in recent years, largely in response to changes in Ofsted's inspection framework. Several maths leads indicated that this had led to mathematics being deprioritised to some extent, with less time available for maths-related INSET compared to other curriculum areas.

Five of the schools described their approach in terms of mastery, while the sixth had a "more traditional" approach, particularly at Key Stage 2, which the class teacher described as "practice, practice, practice" in preparation for national tests. All six schools had chosen to use the White Rose teaching scheme, although they used this flexibly (as a 'spine' or 'guide'), partly to leave room for 'teacher judgement' but also because the materials were seen as pitched too high – and the pace too fast – for their children. However, the focus on mastery and use of White Rose did not mean that all these schools were teaching mathematics in the same way. For example, one school was implementing a distinctive approach to developing reasoning, developed by its MAT maths specialist.

The schools had adopted 'mastery' at different rates over the past few years. In two schools this shift was clearly a result of engagement with the Maths Hub, facilitated by enthusiastic school-based maths leads. One of these leads had since left his school. His successor was less strongly engaged with the Hub and was working to simplify the mastery approach within school, which she felt "people didn't understand".

Maths CPDL in the schools was led by the maths leads, with INSET sessions as a key vehicle for sharing new approaches and embedding whole-school consistency. Most schools interleaved these sessions with other routines, such as learning walks, book looks/scrutiny, moderation and instructional coaching. Some schools were explicit in how they combined this with informal learning.

Maths leads received different levels of support from their senior colleagues; for example, with clear differences in how far headteachers were engaged in thinking about maths pedagogy and practice. Four of the maths leads were engaged in regular networks with leads from other schools, within their MAT, via the Maths Hub and/or the local cluster. One maths lead had also participated in peer reviews of maths practice in other local cluster schools.

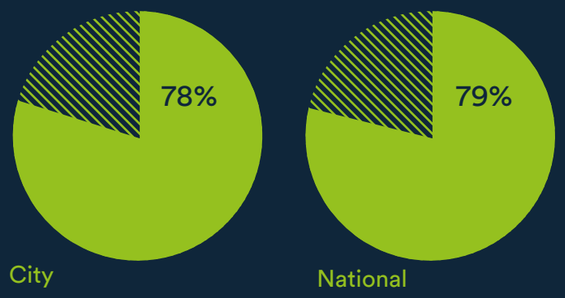
City Profile

Free school meals (FSM)

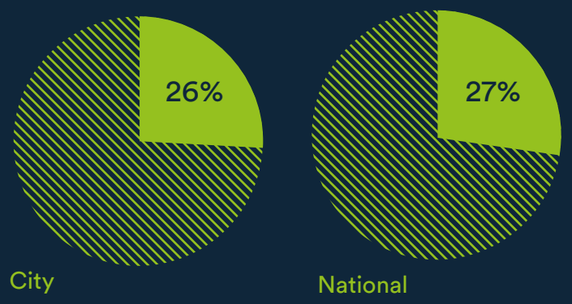
English as an additional language (EAL)

KS2 Maths 2019

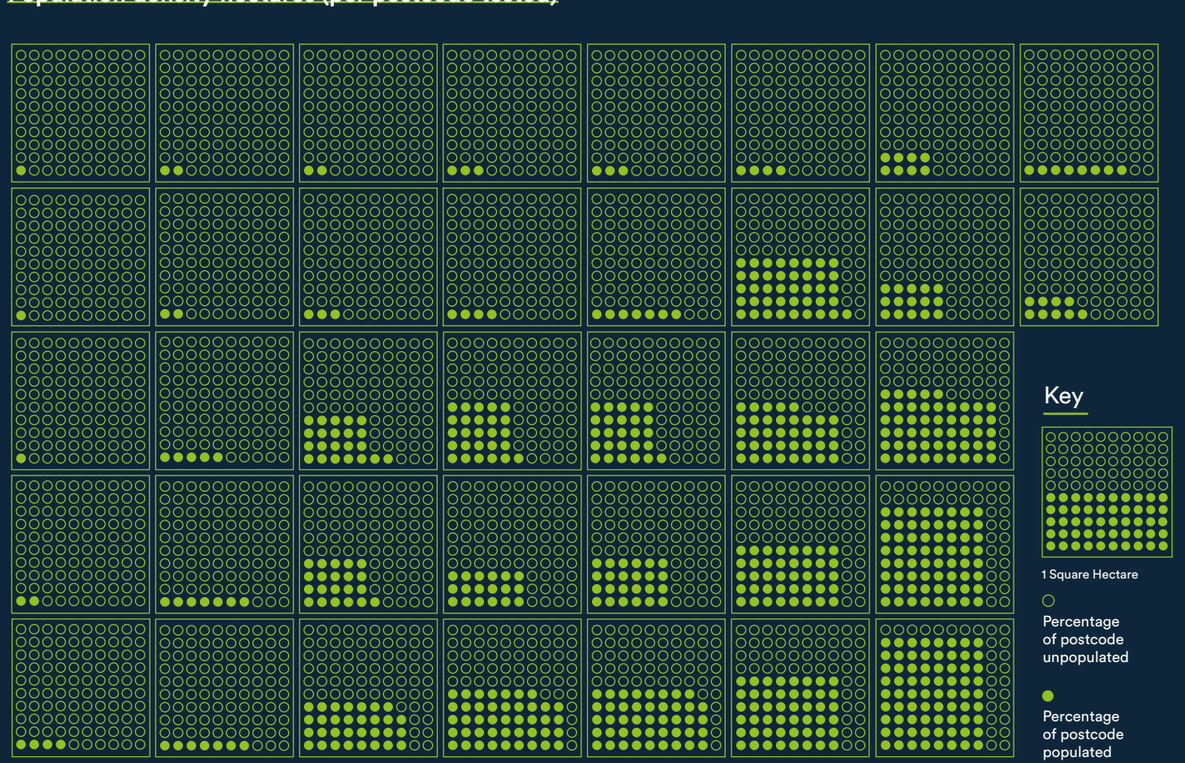
% of Pupils reaching the expected standard in maths



% of pupils achieving a high score in maths

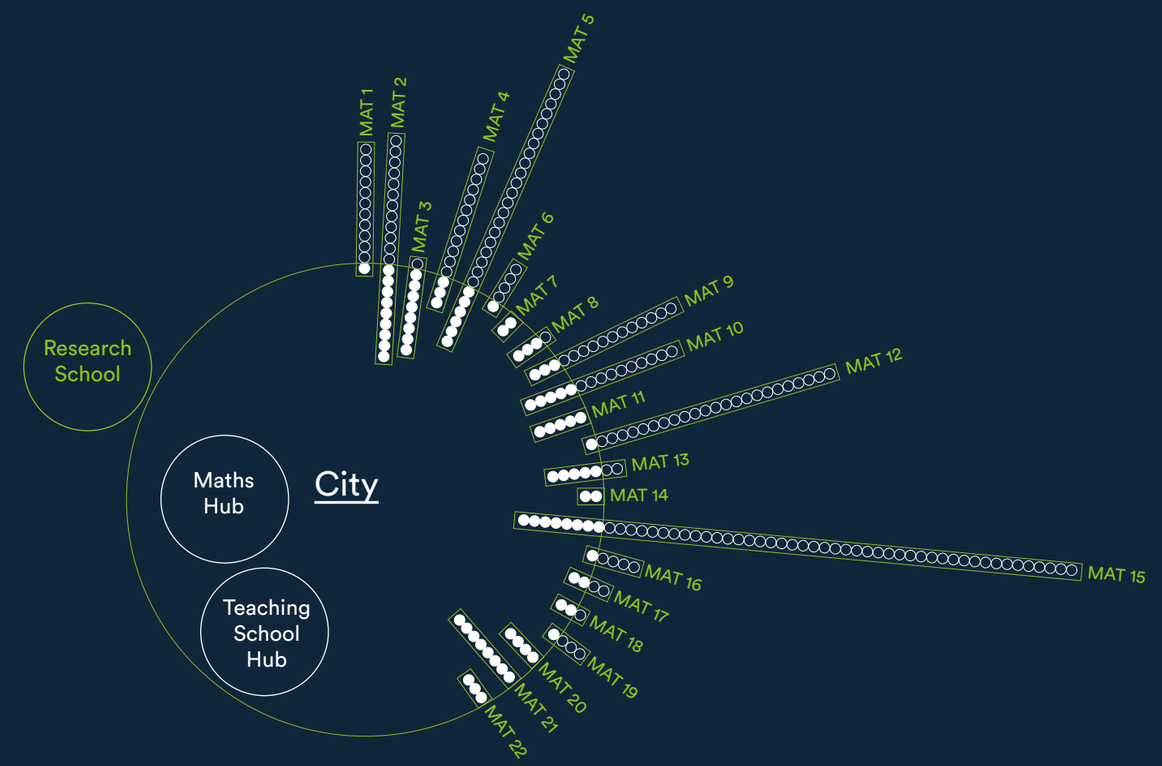


Population density hectares (per postcode tested)



Multi-Academy Trusts and their member schools located within or outside the Local Authority boundary

Location of Maths Hub, Teaching School Hub, and Research School within or outside each Local Authority boundary



MAT 12:
24 Total Schools in the MAT
1 Schools in the LA
23 Schools outside the LA

Percentages of total schools and MATs

Town overview

Fragmented - mixed - bespoke approaches - rapidly changing - largely uncoordinated - hard-working - limited collaboration.

This metropolitan locality is centred on a former industrial town, with an overwhelmingly white British population living in relatively low-cost housing. It is an area of significant deprivation and unemployment, but also includes some suburban and semi-rural areas that are less deprived. Across the Town LA, the proportion of children receiving Free School Meals is |well above the national average, while the proportion speaking English as an Additional Language is well below (see Town Profile - overleaf). Town has been the focus of targeted initiatives funded by central government to improve social mobility. Schools are spread quite evenly across the locality with few being a significant geographical distance from their neighbouring schools. Schools in Town recognise the local challenge of 'disadvantage' and their part in tackling this, with one system leader describing them as "very committed and driven" and "really concerned about those really vulnerable children."

Key Stage 2 Mathematics outcomes in Town were slightly below the national average in 2019, but with a lower proportion achieving at higher levels (see Town Profile). Key concerns for local leaders are raising levels of literacy, oracy, mathematics and aspirations. As one local system leader explained, "the figures are frightening of adults who have got very low maths skills."

The local school and CPDL landscape

The school landscape in Town has undergone a period of significant change in the last five years (see Appendix A for school sample). Whilst some schools became academies over ten years ago, with a steady flow thereafter, the rate of academisation has increased recently. This includes a number of sponsored academies that have been forced to join a MAT due to underperformance. The LA now maintains just over a quarter of all schools in Town, while 19 MATs and 7 SATs oversee the remainder. The increased rate of academisation has led to substantial change in CPDL provision in the area. Where the LA had previously been an important provider it now has a much-reduced reach, despite unsuccessful efforts from the LA's primary mathematics lead to engage all schools, including those in MATs. Previous local cluster networks of neighbouring LA schools have collapsed as individual schools have left to join MATs.

A further contributor to the recent change in CPDL provision is the closure of an influential Teaching School when policy shifted towards Teaching School Hubs. The former Teaching School was led by a well-established boundary spanner in the area, who had been able to forge many connections across systems and "used to be the glue that sort of held certain bits together" (system leader). An additional contribution to the recent changes in CPDL landscape is the place of centrally funded government initiatives, which had mostly concluded.

The overriding description of the local landscape from participants is one of fragmentation. The government-appointed organisations responsible for offering CPDL to the locality (Teaching School Hub, Research School, Maths Hub and LA) all struggled to navigate the fragmented landscape. Each of these providers (except the LA) is hosted by schools and MATs that are located outside of the boundaries of the town, although some of these MATs operate schools in the locality and some have local leaders working on their behalf. This fragmentation has continued despite efforts by local system leaders to engage all schools and coordinate their offer (e.g. half-termly meetings between LA and Maths Hub leaders). There are no clear mechanisms for shared sense-making around the CPDL needs and provision in the locality.

Maths CPDL in Town

Engagement in mathematics CPDL outside of the individual school or MAT is low. There is a significant amount of 'home-grown' CPDL taking place in schools where the school or MAT maths lead designs and leads professional learning for their colleagues. CPDL routines vary, and often combine aspects of professional learning with monitoring and accountability. Common practices include regular so-called 'deep dives' to analyse and develop practice in classrooms, sequences of professional development meetings, regular monitoring checking curriculum fidelity, 'book looks', learning walks, year group coaching, individual conferencing and team teaching used in different schools. There is also some informal, self-directed CPDL in some schools with teachers accessing online materials or networks, as well as their closest teaching colleagues, to support their professional learning needs.

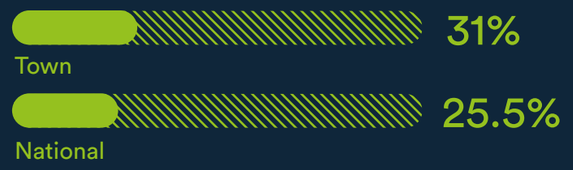
Two main mathematics schemes, both of which seek to develop 'mastery', are used to support mathematics teaching, but in different ways. One of the sample schools in Town follows its chosen scheme closely but the others have adapted theirs to create a bespoke approach. Indeed, one LA school use a blend of four schemes:

We were a [scheme] school for a while. And we have kind of come out of the other side of that. We didn't keep it going, but we did take from that what we liked. So, we've kind of morphed lots of different things together, and I drive that (maths lead).

There is some engagement from school maths leads with the local Maths Hub but levels of participation are lower in Town than surrounding areas. Maths leads that do engage with the Maths Hub rate the CPDL highly and view it as a key feature of the mathematics professional learning landscape. Schools in MATs are less likely to engage, with some examples of 'boundary keeping' (i.e. where collaboration outside the MAT was prohibited). For example, one school that had previously been highly engaged had ended its work with the Hub when it joined a MAT. Local system leaders speculated that MAT schools "often feel that they've got it covered and don't necessarily look beyond their trust" (system leader) and that some trusts wanted to avoid introducing alternative approaches which might conflict with a chosen model. School leaders working in MATs confirmed that the trust was their main source of CPDL and that engagement with non-MAT CPDL depended on it meeting an identified gap and alignment with the trust's existing approach. Some MATs have dedicated directors of mathematics who are responsible for identifying and addressing trust-wide needs, while others facilitate school maths leads to work together on trust-wide mathematics policies.

Town Profile

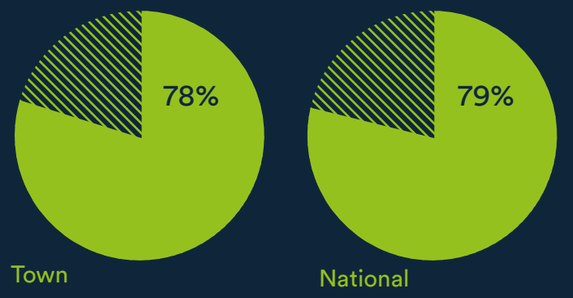
Free school meals (FSM)



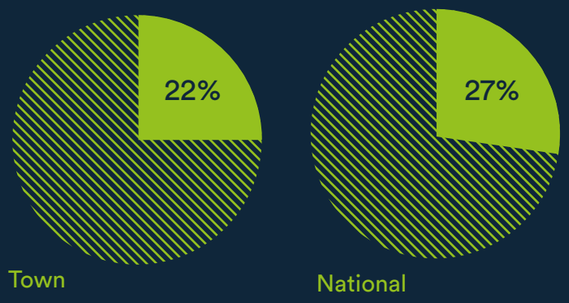
English as an additional language (EAL)

KS2 Maths (2019)

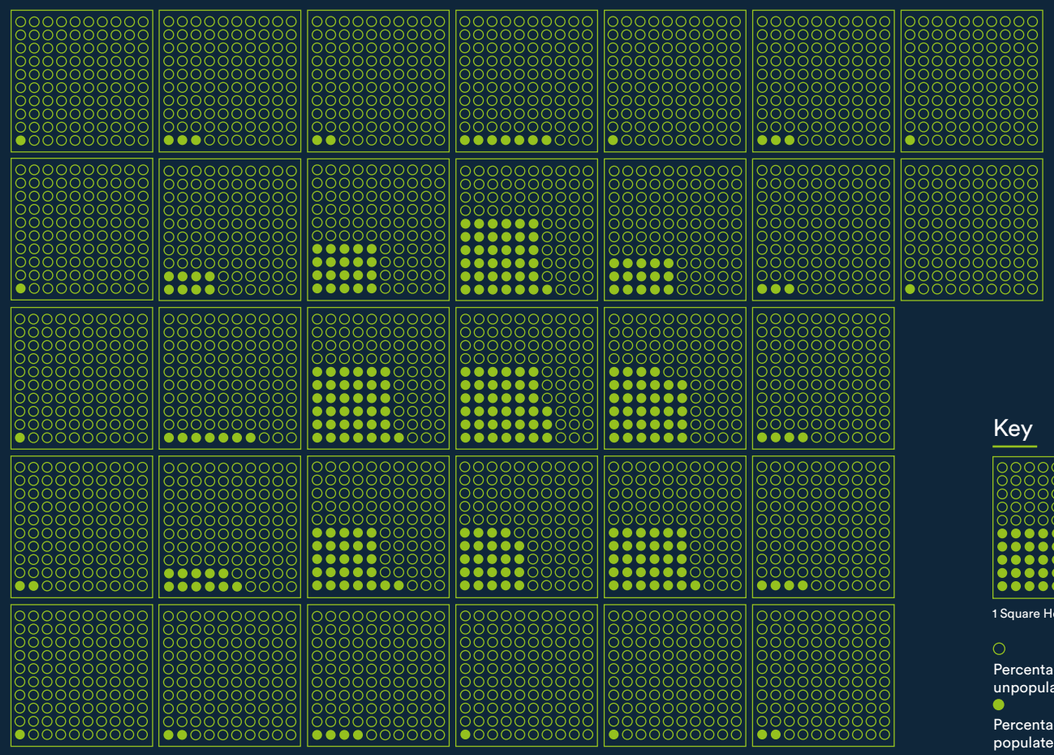
% of Pupils reaching the expected standard in maths



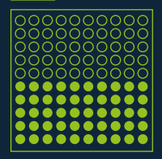
% of pupils achieving a high score in maths



Population density hectares (per postcode tested)



Key



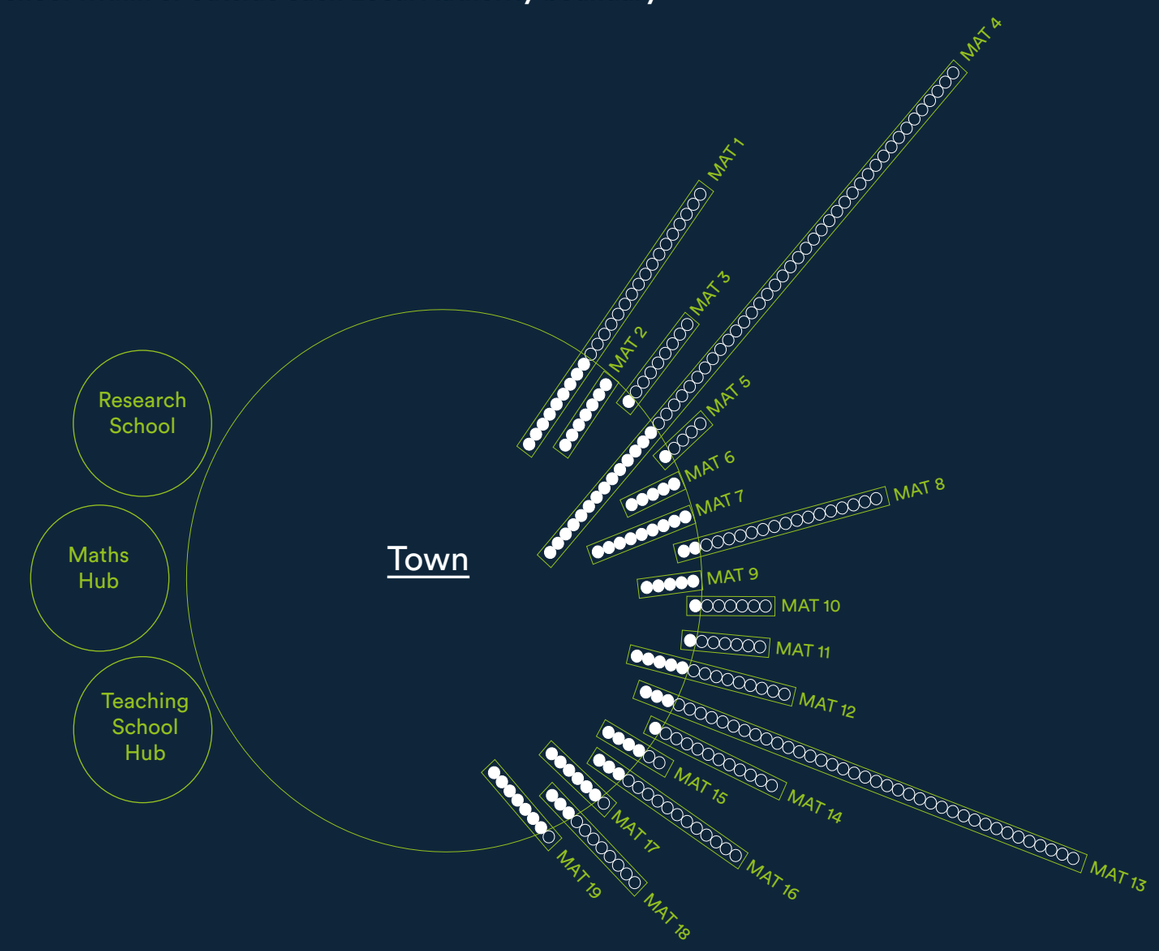
1 Square Hectare

Percentage of postcode unpopulated

Percentage of postcode populated

Multi-Academy Trusts and their member schools located within or outside the Local Authority boundary

Location of Maths Hub, Teaching School Hub, and Research School within or outside each Local Authority boundary



MAT 12:
14Total Schools in the MAT
5 Schools in the LA
9 Schools outside the LA

Percentages of total schools and MATs

Shire overview

Dispersed rural/town - coordinating professional networks - few dominant MATs - evolutionary change - 'external' Hubs/TS - small school challenges.

'Shire', part of a larger shire LA, covers around 500km2 and comprises a mixture of towns, villages and hamlets as well as rural areas. It includes areas of deprivation, especially in post-industrial town centres that are now home to diverse populations. Isolated farming communities also struggle with historical patterns of unemployment. This patchy population density together with affluence and deprivation means that "shire is polar, very, very polar" (system leader). Across Shire LA as a whole, the proportion of children receiving Free School Meals and speaking English as an Additional Language is well below the national average (see Shire Profile - overleaf).

Key Stage 2 Mathematics outcomes in Shire were above the national average in 2019, but with a slightly lower proportion achieving at higher levels (see Shire Profile).

The local school and CPDL landscape

Shire has moved more gradually towards academization than City or Town (see Appendix A for school sample). The LA now maintains just under two fifths of all schools in Shire, while 21 MATs and 18 SATs oversee the remainder. These MATs tend to be smaller and more locally based than the trusts operating in City and Town (see Shire Profile). This picture appears similar to many other rural areas across England, partly as a result of limited MAT capacity or appetite to work across geographically distant and, often, financially constrained schools.[73] There are long-lasting alliances and collaborations between schools in Shire and a strong sense of identity with the local area. This is especially true in schools with staff who grew up locally. However, there were exceptions to this mentality, especially among staff working in well-established and larger MATs.

System leaders consistently present Shire as a cohesive system with a flat professional network of primary heads brokering new entrants and outside initiatives. Most significant is the local head teacher network, which has been spun out into a limited company with a paid chair. This is now a paid-for service, semi-independent of the LA, which provides an important, shire-spanning strategic leadership role. This role includes coordinating and signposting CPDL opportunities, for example through a widely-read weekly email to members. The LA remains the main CPDL provider in the region, not least because the Maths Hub and new Teaching Schools Hub are both centred away from Shire. However, these hubs are connected to Shire through the exchange of personnel on steering communities and management groups.

The local schooling landscape appears to be generally stable and highly collaborative. However, its local headteacher network can also be seen as an attempt to limit the influence of external CPDL providers and to maintain the influence of established local leaders.

There is certainly some frustration with multiple new actors and the appearance that the locality lacks an organising framework to make sense of CPDL opportunities. One system leader described this stable disunity using a bicycle metaphor, "Bicycles have got two hubs and a frame. And the frame is what connects the hubs… without the frame there can be no movement forward… So what's happening is that the hubs exist on their own… There isn't a bike frame that's been organized".

There is a striking contrast between large and small schools' ability to access external CPDL. Teachers in smaller schools take on multiple subject lead responsibilities and are rarely released to attend external CPD. In comparison, larger schools can afford cover and are able to release staff for CPD and even have subject specific curriculum teams. Members of larger MATs have the benefit of subject directors who organise trainings with external influencers and support routines for school-to-school support.

There is evidence that the Maths Hub is playing a boundary spanning role, by connecting maths leads locally and across multiple hubs. Where practitioners are not supported with formal CPDL, social media is often accessed and used to fill the void. Classroom teachers and some maths leads spoke of accessing resources and information from professional groups on Facebook and using TikTok videos during lessons. Some of these private professional groups can number in the thousands and are comprised of teachers across the UK.

Maths Practice and CPDL in Shire

There is considerable variation in approaches to mathematics teaching across Shire and large discrepancies with access to CPDL opportunities. School visits identified three different maths schemes used by schools - Maths No Problem, Power Maths and White Rose. This, combined with the mixture of LA maintained schools, single-academy trusts, and MATs, creates variation in approaches to mathematics teaching. One system leader spoke to this diversity:

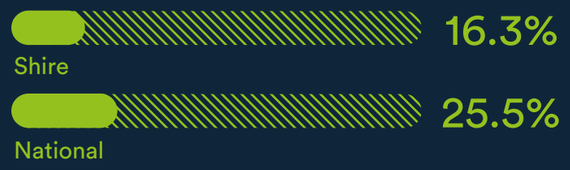
Our [MAT] is very much, we don't use a scheme, we don't use a textbook and we sort of really focus on sort of small steps to depth, and we developed teacher pedagogy and understanding… You then have other [MATs] who have a different philosophy and might have you know, sort of, set textbooks or whatever… You've also got schools that have very limited maths support… And they're using a lot of older materials and materials that don't reflect that… mastery approach.

Larger MATs appear to have an advantage in terms of accessing CPDL, especially when compared to small rural schools with mixed year group classes and few full-time staff. Those working in larger MATs commented on the advantages of having a maths subject director who could be outward facing and cultivate CPDL opportunities for teachers across the trust. They also commented on how their MAT created opportunities for practitioners to network, for example through regular subject leader meetings. These larger MATs are beginning to form stronger internal identities (for mathematics) and are perhaps engaging less fully with the other school structures in Shire.

Engagement with the Maths Hub is mixed, though is developing following a recent reorganisation of the Hubs' 'patches' and a commitment to more active outreach by the Hub. The chair of the primary heads network considers the Shire branch of the Hub to be key to the local maths CPDL landscape. There is some progress in organising a broader framework for maths CPDL. One system leader explains that they have 'create(d) something called the [Shire] Mathematics Partnership, and that is basically us, the research school and the local authority.' They have 'a community of local leaders of maths education. So, they're all the people that lead on maths in some shape or form with across all our areas.'

Shire Profile

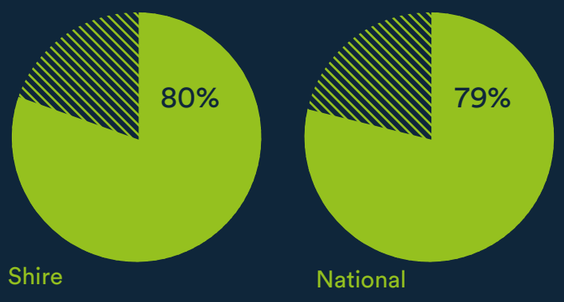
Free school meals (FSM)



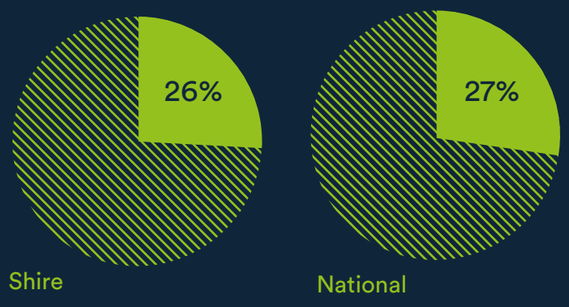
English as an additional language (EAL)

KS2 Maths (2019)

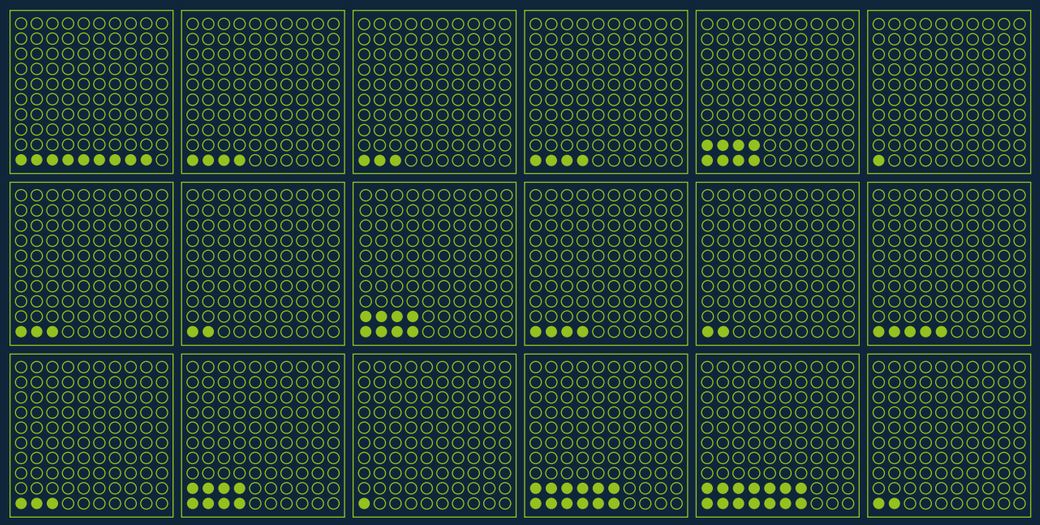
% of Pupils reaching the expected standard in maths

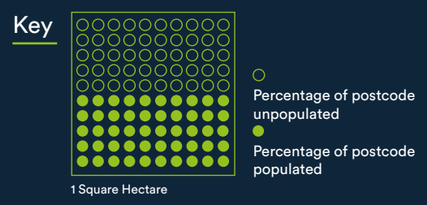


% of pupils achieving a high score in maths



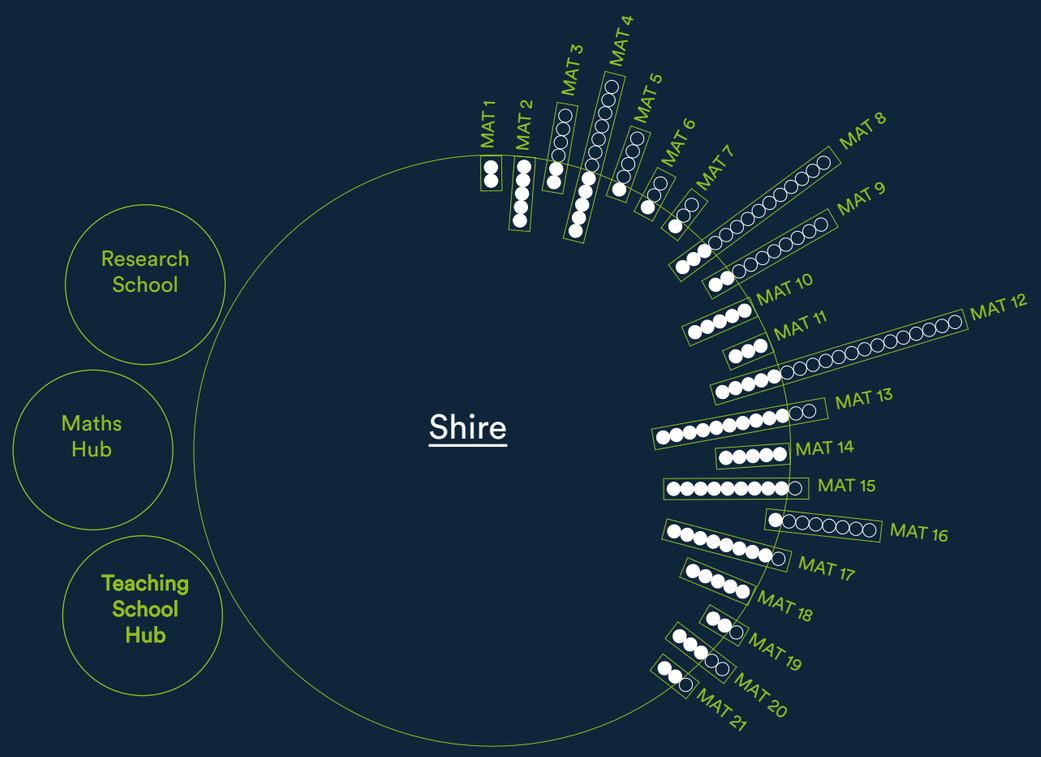
Population density hectares (per postcode tested)





Multi-Academy Trusts and their member schools located within or outside the Local Authority boundary

Location of Maths Hub, Teaching School Hub, and Research School within or outside each Local Authority boundary



MAT 12:
19Total Schools in the MAT
5 Schools in the LA
14 Schools outside the LA

Percentages of total schools and MATs

Findings: six core features of local learning landscapes

05

Section 3 set out the project's conceptual framework, including six core features of a local learning landscape. This section utilizes those six features to explore similarities and differences across the three locality cases.

Local lens: multiple and changing versions of 'local'

The 'locality' in which interviewees worked was important to their practices and professional identities. This was particularly the case for those working in schools, who saw the local community and the contexts and characteristics of the children and families who lived there as important. School-based interviewees had different levels of engagement with the other schools in their immediate geographic area, largely reflecting how long they had worked in that locality and the extent to which their role included external networking. Many also saw themselves working within a wider set of 'locals' – often simultaneously – such as the MAT in which they worked, the CPDL hubs they accessed, or the online communities they engaged with. The following quote captures the evolving and multi-scaled nature of England's educational landscape, whilst also emphasizing the significance of place in professional identities:

First and foremost, I would say I am a [small town] teacher, 'cause I've been here for so long and I was here when it was a community primary school and the LA controlled it. But, more and more, I do see myself as part of, I work for [small town] but in the [MAT] trust, and I do see myself as a member of that trust.
(Class teacher, Shire)

Individuals not only operate in multiple locals, but also perceive those different locals from their subjective points and angles of view. For example, a teacher or leader who remembers the days when the LA brought all schools together to undertake CPDL will have a different perspective to one who has only ever worked as part of a non-local MAT. As a result, one educator's local is never the same as another's, even when they are colleagues in the same school. These differing interpretations of place are clear in the interviews, although most respondents tended to have a dominant perspective: some considered local from the ground up (e.g. the school and its community), others saw it from the middle in or out (e.g. the MAT, LA, or headteacher networks), while others perceived it systemically, from the top down (e.g. in terms of how different hubs are configured).

Within this overall picture, there was a widespread recognition that geographically 'local' arrangements are becoming more fragmented as LAs become less significant and as schools join different MATs. At one extreme was a view that geography is no longer relevant, expressed by this system leader:

It's not defined by geography anymore. I think that's the point for me. Local is not defined by geography... they would perhaps sometimes see their local area... as being... their MAT, more so than a geographical area.
(System leader)

To some extent this view was corroborated by school-based teachers and leaders. For example, in the view expressed in all three localities that the LA role had become less important and that schools were having to think and work in different ways as a result. It was also common to hear from teachers and leaders working in MATs that the trust was now their main source of development and, sometimes, professional identity, with the clear implication being that 'local' identities were being eroded as a result:

In the past I would have been asked to meetings with colleagues... in the local schools around Town, whereas now, all the CPD that we would go to would be through the trust.
(Maths lead, Town)

Importantly, there were clear differences between MATs, for example in terms of size (which impacts on local-ness) and ethos (for example, in how far the trust standardizes practice or allows more flexibility). These differences meant that perceptions of 'local' could differ between staff working in different MATs within the same locality. One school leader reflected on these differences by recalling their experiences working for an LA maintained school, a school in a large MAT, and – currently - a school in a small MAT. Their engagement with the local learning landscape changed in each case:

Going back to my previous schools - the first school, you know, all of the CPD was accessed through the LA as a maintained school. And then I moved to a second school, which was part of a MAT with 20 odd schools, most of [the CPD] was delivered... [through MAT-run] CPD courses and termly updates, so totally removed from anything the Local Authority was doing. We weren't involved with the Local Authority at all. And then here [i.e. small MAT], there are bits from the LA.
(Deputy Head Teacher, Shire)

Another common trend which signaled the weakening of geographically 'local' identities was for previously strong local clusters, partnerships and pyramid arrangements (i.e. a secondary working with its feeder primaries) to

have splintered, as schools joined different MATs. Several headteachers lamented this loss of local, place-based collaboration, arguing that the schools involved were all serving the same set of children:

I do think it's a bit of a shame that academisation has caused that fracture in the locality because you are talking about... similar children from this town with similar issues. (Class teacher, Shire)

Some heads, including some operating within a MAT, had tried to maintain or re-establish local links between schools but had found this difficult. This was largely because MATs were seen to require schools to adhere to the rhythms and routines of the trust, including in terms of participation in CPDL, and there was simply not the time or capacity for schools to also participate in cluster-based meetings and routines, which might be seen to duplicate or even contradict these ways of working. However, this fracturing of local partnerships was not complete and a balance between the old and new was often visible, depending on the issues under discussion:

Where everyone's together and we're discussing local issues or working with the high schools for transition, all the schools will be there irrespective of academy or non-academy. But, for example... sometimes they've done curriculum workshops and things ... we would opt out of that because we do that at trust level.
(Headteacher, Shire)

In a small number of cases, local collaborative arrangements had been sustained even after (some) schools had joined different MATs. In these examples, collaboration had been maintained thanks to strong pre-existing relationships between local participating headteachers, rather than as a result of any deliberate brokerage by the LA or by the MATs themselves. As discussed in the section on professional learning below, staff in schools that participated in these enduring local clusters saw this as an important source of professional learning:

We still work together as heads because even though quite a few of us are in different trusts, some aren't. Some are in much bigger trusts than us or much smaller trusts than us and we still try and work together, because ultimately we're all here in the same area with the same goals, aren't we, that wanting the best for these children.
(Headteacher, Shire)

Turning to the curriculum hubs and the various other new 'local' scales (mostly regional) outlined in Section 2, there was limited evidence that these arrangements have generated a strong sense of identity or commitment among interviewees despite generally being valued as providers of CPDL and related expertise, as we explore below. However, there were exceptions to this. One group that identified strongly with one or more hubs was schools that felt isolated for one reason or another, where key staff were actively looking for professional networks and support. One example was a school in City that was part of a geographically dispersed medium-sized MAT, where the school had no close neighbours in its trust.

The second group comprised a subset of school-based maths leads who had been closely involved with their Maths Hub and who were particularly passionate about the mastery approach. For this latter group, the Maths Hub not only gave them access to a network of like-minded peers and rich opportunities for professional learning, but it had often helped to accelerate their career and given them access to wider opportunities.

The findings outlined so far apply across all three localities, but there were also important differences between the three areas in terms of how 'local' was understood and made meaningful in everyday practice. One example comes from Shire, where the headteachers have come together to develop and sustain a place-based membership network, even in the context of some schools joining MATs. We explore this and other examples in the following section - Linking Systems - but the point is that each locality is developing differently and that this, in turn, influences how the practitioners within these localities perceive their 'local'.

Finally, a clear trend is how virtual 'locals' have emerged and developed through online collaborative learning and social networking, often accelerated by the pandemic. Numerous interviewees explained how once distant CPDL opportunities were now being accessed on a laptop or phone, collapsing both old forms of nested and networked locals. Online learning and networking can enable blends of physical and virtual, designed and organic networks, although it can also mean that teachers in adjacent classrooms might have access to very different communities of practice. At the same time we heard from multiple interviewees that online learning, whilst offering many advantages in terms of travel time and the ability to access forms of expertise that might not otherwise be available, was valued less than local, face-to-face events because these offer all the benefits of in-person interaction.

Linking systems: strategic, networked and balkanized models

In Section 2 the impact of educational policy since 2010 was characterized in terms of system fragmentation and partial reformation, both for school structures and CPDL provision. Within this broad trajectory of change there are several examples of initiatives and structures that have come and (often) gone. For example, Teaching Schools have been replaced by Teaching School Hubs, new curriculum hubs and Research Schools have been introduced, while MATs have grown and adapted as they have taken on additional schools. These waves of policy-driven change have washed across the three localities, with new initiatives layered on to pre-existing structures, relationships and ways of working. In the past, the LA would have played a role in buffering and integrating policy change and ensuring local coherence, but with the role of LAs now reduced it falls to a wider group of leaders to manage this process. This section outlines how school and system leaders in each locality have worked to link different CPDL provision together in pursuit of a coherent and equitable offer for schools.

In City, a core group of local system leaders have been largely successful in securing collaborative bids over time, enabling them to integrate different policy initiatives and to sustain a relatively coherent CPDL offer. The Maths Hub works closely with the new Teaching School Hub (which evolved from a former TSA), supported by several local MATs as well as the LA. Leaders within these hubs work hard to maintain a City-wide approach as far as possible. For example, they recognized that some recently de-designated TSAs were unwilling to "relinquish their power" and were still running as "CPDL businesses", so they employed a trusted broker to engage these TSAs in developing a locally responsive school improvement offer, despite this not being part of the official TSH remit. The linkages between hubs and systems leaders in City were often replicated at school level. For example, maths leads in several case study schools participated in a local mathematics network formed from an earlier Maths Hub-run Teacher Research Group. Interviewees in schools in City generally recognized the value of this strategic, networked approach, as the following quote indicates:

... it's why the hubs work so well, I think, because they can cross boundaries in terms of trusts and the local authority, and especially with the [City Maths Hub] being so well established and well regarded, then you get buy-in from most of the schools that you're working with, and then you can engage with more local schools that way.
(Headteacher, City)

The model for linking systems in Shire is quite different to City. Here, system leaders have created an independent, subscription-based network of local headteachers, led by a highly regarded former local headteacher. This network leader sits on the boards of the Maths Hub and Teaching School Hub, both of which are based outside the local area. Drawing on these links they connects schools to hubs and the LA, coordinating information about CPDL for schools through a weekly newsletter and bringing a level of cohesion to the local learning landscape.

In contrast, the landscape in Town is more fragmented. The roll back of a previously dominant LA, the ending of central government funding for local CPDL offers, the closure of an influential Teaching School and the absence of any strong locality-wide partnership arrangement has led to a weakly-coupled system. Both the Maths Hub and Teaching School Hub are based outside the locality; each hub does have some engagement from a minority of case study schools, but there is limited interlocking of organisational structures despite some attempts to initiate this. Meanwhile, schools that have joined non-local MATs have been required to sever existing links with the Maths Hub and to adopt their MAT's preferred approach to maths teaching. Across the locality, coordination between schools is sporadic and focused on practical issues, such as managing an increase in pupil numbers – "it's been more about necessity rather than actually working together in terms of developing teachers" (Headteacher, Town).

Two factors appeared particularly significant in influencing how far systems and organisations for CPDL were linked in each locality: the geographic location of providers and local MAT dynamics.

The geographic location of CPDL providers appears to influence linking at locality levels. In City, the Maths Hub and Teaching School Hub are both based within the LA boundary (while also supporting wider regional footprints). The Research School is in another part of the region, with weak links to local schools, but is working via the LA to offer a focused CPD program in the area. In Shire and Town the hubs all operate from outside the locality, relying on local partners to broker relationships. In Shire, this model operates reasonably well thanks to good relationships and high levels of trust in the former headteacher who coordinates the network. However, in Town, the absence of any such local network leads to suspicion of non-local providers:

I suppose it depends how wide you define your geographic locality doesn't it? As to how wide that goes; if it is literally just 'Town'. I mean there are the systems in place like the Maths Hub, but it's not 'Town Maths hub' and it's not a 'Town MAT' as such. There's even the Teaching School Hub, and again, they're not local. I'd say they are wider than that. So those things do happen within Town, but they're not just Town based.
(Maths lead, Town)

The second factor relates to MAT dynamics in a locality. This has several aspects including:

1) the geographic locus of the MATs (i.e. local/non-local),

2) school performance and levels of concern around MAT expansion/take over (in particular where the hub is operated by a MAT),

3) MAT ethos (i.e. more or less standardised) and

4) the extent to which MATs (are seen to) collaborate with each other and with the LA.

Capturing several of these issues, one maths hub lead observed:

There exists a certain level of sort of mistrust from the existing LA maintained schools in relation to the way that some of the trusts work and and how they manage their schools in their trusts. (Maths Hub lead)

In summary, across the three localities, systems for CPDL are more and less tightly coupled. This variability impacted on coherence, equity and quality in CPDL for schools and teachers, an issue we return to in Section 6.

Professional learning: formal, informal, individual and collective

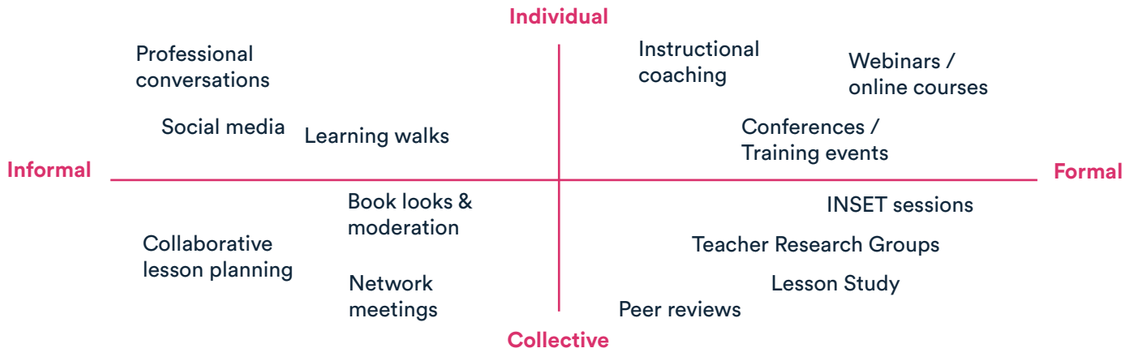
Interviews with school-based teachers and leaders asked 'what, or who, do you think has been most influential in the way that you teach maths?' Responses highlight the importance of initial teacher education in shaping teachers' identities, interests and practices, and how professional learning and growth then continues throughout a career. Numerous interviewees explained how this professional learning had helped them to become confident, often enthusiastic, teachers of mathematics, sometimes despite not having enjoyed the subject at school themselves:

I worked with the Assistant Head pretty closely for the first couple of years, shadowing her... She was the Maths Lead and she knew so much about maths and sent me on lots of training. So, I've worked with the Maths Hub. We did a TRG - which is a Teacher Research Group - and went to, like, maths days, worked with the NCETM and went to other schools and watched lessons. My NQT year was really useful, as well, because I just went round and watched all the teachers in the school basically... So just all of that together has informed how I teach maths now.
(Maths Lead, City)

The career-long development described by interviewees involved complex combinations of formal and informal professional development and learning. A minority could describe specific courses, events or individual experts that had had a particularly significant impact on their thinking and practice; for example, watching a teacher from Shanghai teach maths in a demonstration lesson. However, most of the professional learning described was more incremental, involving combinations of 'learning on the job' with more intentional development activities that had varying degrees of formality.

Figure 5.1 shows the most common professional learning activities encountered across the 19 schools visited. The diagram is structured on two dimensions - formal to informal and individual to collective - reflecting the continuous and embedded nature of most professional learning. Planned, formal development such as INSET sessions or a course, frequently provides a core focus for individual and collective development efforts. However, these formal activities invariably co-exist with a range of other modes of learning, some of which might be intentional and some of which occur 'bottom up' as busy professionals find ways to address their individual and collective problems of practice.

Fig 5.1: Modes of professional learning in the 19 schools



Teachers were asked who they would turn to if they needed help or advice with their mathematics teaching. This was almost always other colleagues, often those teaching in the same year group (in two and three form entry schools) and/or an expert practitioner such as the school's designated maths lead. These professional conversations were the most common example of 'bottom up' professional learning. There were also some examples of individual teachers seeking out their own professional development, for example by participating in online communities or attending courses or conferences, either online or at weekends.

Notwithstanding these 'bottom up' examples, most professional learning is shaped by the school and, for schools in MATs, the trust. The headteacher and maths lead play a key role in determining this professional learning through how they organise formal development activities and how they work to align these with wider school improvement processes, tools and routines. In most schools, professional learning is geared towards addressing school-wide priorities, usually with some scope for addressing individual needs and priorities. For example, the headteacher of a three-form entry school explained the approach as follows:

The starting point is the School Improvement Plan and whatever's on the School Improvement Plan becomes part of a whole school and performance management targets. And so staff, when they meet with their team leaders, will have a discussion about 'Well, your objective is this and this...So you're going to be involved in the training to do with [this], which might mean that you attend this particular INSET day in June'... it's individualised training where the teacher and the LSA have some ownership over their own CPD. So they can say, well, 'I think I need this' as well as the team leader coming at it from the other direction, saying 'well, this is in the School Improvement Plan and you need to work on this.' So the two meet in the middle."
(Headteacher, City)

In a minority of schools, non-maths-specialist teachers and teaching assistants had attended external training in mathematics, either subject-knowledge or pedagogy related. More common was for the maths lead to attend external training, networks and events and to then feed this back to staff in school. This generally relied on a cascade model, with the maths lead running periodic whole-school INSET days or sessions: "one member of staff is the point person. They gather that information and then they come and disseminate it" (system leader). Having introduced a new approach or technique in an INSET session, the maths lead would then seek to embed this: for example, by undertaking periodic learning walks or observations of lessons, and then providing feedback or instructional coaching geared towards implementation.

For schools in MATs, and particularly those in larger trusts that had sufficient resources to employ a dedicated maths specialist in the central team, the content of formal professional development as well as the mechanisms through which it was shared and embedded might be more or less tightly prescribed by the trust. For example, a school-based maths lead working in a regional trust described an integrated approach which combined trust-wide and school-led sessions and networks:

So we have seven INSET days. Two of those are trust-wide conference days, so there's a huge amount of CPD that goes on at those, we have guests speakers for example that come in or opportunities for teachers to sign up to workshops that are relevant for them.... The other INSET days are then done in-house (i.e. run by the school)... And then we also have a weekly staff meeting every Wednesday for an hour...we have a moderation session every term which is within the [trust]... We also then have... our primary academy collaboration, which is another trust wide meeting."
(Maths lead, City)

Maths Hubs played a role in providing CPDL in all three localities but, as we outline in Section 4, levels of school and MAT engagement in this provision varied. Among schools that engaged this Maths Hub provision was well regarded and seen to be led by expert practitioners, often leading to participation in ongoing local networks. In the schools and trusts that engaged, teachers and maths leads had access to a wider range of professional development and learning opportunities than in schools that did not engage, although some larger, non-engaged MATs had the capacity to offer a significant program as well.

Practices, tools and routines: fostering epistemic communities

The previous section indicated how formal and informal CPDL for teachers is frequently shaped by the wider practices, tools and routines adopted by schools and trusts. For example, Figure 5.1 included examples of routines, such as peer reviews, book looks/moderation, learning walks, and subject networks, which provide important vehicles for professional learning while also serving wider improvement or assessment purposes.

This section explores the role of practices, tools and routines in more depth. Section 3 introduced the concept of epistemic communities, characterised by shared theories, language and tools.[c] An epistemic community can provide a platform for collaboration within a single organisation or across multiple organisations and networks by facilitating the construction, sharing and application of professional knowledge.[74] However, if every school and trust develops its own distinctive practices, tools and routines, then meaningful collaboration will likely become more difficult, because practitioners will need to spend time constantly negotiating these areas. In this section we use this notion of epistemic communities as a heuristic, to explore how commonalities and differences in practices, tools and routines within and across the three localities influences coherence.

The research revealed numerous examples of practices, tools and routines, with illustrative examples provided in Figure 5.2. Many of these examples were not maths-specific, reflecting wider educational processes and outcomes. For example, the 'practices' column includes both generic pedagogic examples (e.g. differentiation, formative assessment) as well as mathematics-specific examples (e.g. calculation). The tools column includes national frameworks and requirements (e.g. national curriculum, Ofsted/EIF) which all schools are expected to adopt, as well as tools that remain voluntary (e.g. White Rose).

Individual schools and, increasingly, trusts across all three localities were working to develop consistency in how selected practices, tools and routines were implemented as a means of building coherence and as a platform for productive professional collaboration. However, one challenge for school and trust leaders in this area was the lack of agreement on what 'mastery' involves in the mathematics classroom and how it could best be developed. One system leader argued that this was due to a lack of clarity from national policy, when compared with phonics:

So it feels like the national, the national sort of discourse around phonics, is somehow taking precedence over a national discourse around mathematics teaching, to me. And it's the messages coming from the DfE, from the English hubs, with funded arrangements to support schools with buying these sort of approved phonics schemes. But there's not the same sort of provision in place through Maths Hubs, as far as I can see.
(System leader, City)

I suppose it depends how wide you define your geographic locality doesn't it? As to how wide that goes; if it is literally just 'Town'. I mean there are the systems in place like the Maths Hub, but it's not 'Town Maths hub' and it's not a 'Town MAT' as such. There's even the Teaching School Hub, and again, they're not local. I'd say they are wider than that. So those things do happen within Town, but they're not just Town based.
(Maths lead, Town)

The second factor relates to MAT dynamics in a locality. This has several aspects including: 1) the geographic locus of the MATs (i.e. local/non-local), 2) school performance and levels of concern around MAT expansion/take over (in particular where the hub is operated by a MAT), 3) MAT ethos (i.e. more or less standardised) and 4) the extent to which MATs (are seen to) collaborate with each other and with the LA. Capturing several of these issues, one maths hub lead observed:

There exists a certain level of sort of mistrust from the existing LA maintained schools in relation to the way that some of the trusts work and and how they manage their schools in their trusts. (Maths Hub lead)

In summary, across the three localities, systems for CPDL are more and less tightly coupled. This variability impacted on coherence, equity and quality in CPDL for schools and teachers, an issue we return to in Section 6.

[c] We focus here on practices, tools and routines, as illustrated in Figure 5.2, rather than theories, language and tools. We see 'practices' as combining the theories and language that practitioners adopt. Adding a focus on 'routines' allows us to focus more clearly on the professional learning processes that support the development of shared practices and tools.

Figure 5.2: Examples of practices, tools and routines encountered in the research

Practices	Tools	Routines
Pedagogic approaches, e.g. mastery pedagogies	National curriculum, school curriculum maps	Teacher Research Groups
Learning objectives and outcomes, e.g. reasoning, calculation	Curriculum schemes/resources e.g. White Rose Maths, Maths No Problem, Mathematics Mastery, Twinkle	Network meetings, e.g. for Maths Leads
Pedagogic techniques, e.g. differentiation, interleaving	National inspection framework, e.g. EIF, Ofsted reports	INSET days / conferences
Formative and summative assessment, e.g. hinge questions, standardised tests	Assessment tests, data and systems (national and school/trust level)	Peer review
Professional development approaches, e.g. cascade	Pedagogic tools, e.g. bar models, manipulatives etc	Instructional coaching
	School-level policies and tools, e.g. School Improvement Plan, Professional Development Plans, Lesson planning templates, Lesson observation schedules	Professional learning communities
	Evaluation tools, e.g. questionnaires	Deep dives
	Online learning tools, e.g. webinars	Learning walks
		Lesson study

Reflecting this ambiguity, mastery was interpreted by schools in different ways, but tended to include 1) reduced within-class differentiation (often with parallel concerns around how to meet the needs of lower and higher attaining pupils, 2) more teacher-led instruction, 3) use of manipulatives and 4) an emphasis on reasoning alongside procedural fluency.

In a minority of schools, the lack of clarity around the meaning of mastery seems to have been compounded by the attempts of enthusiastic maths leads to introduce it too quickly and, perhaps, with too little attention to the CPDL required. As a result, teachers had become overwhelmed by what was seen as new jargon and expectations, as this maths leader explained:

I think people find it tricky. I think when our previous maths lead was trying to put stuff in place, it was like 'we need to do all of this!' And, actually, it was too much, because people didn't understand how to use... counters or deans, or why that was the trickiest question, or like 'what does that bar model even show, what's the purpose of it?' **(Maths lead, City)**

In order to address this lack of clarity around mastery, many leaders had chosen to adopt shared tools in the hope that this would provide a scaffold for the new practices involved. Most commonly, this involved the selection of a specific maths scheme, with associated CPDL to embed this, as this school maths lead explained:

When we started on the maths mastery approach... we decided with SLT approval that we were going to implement the [X] maths scheme. So as a result of that we had to arrange quite a lot of CPD in terms of 'What is mastery? What is a mastery approach? Why are we deciding to go down the mastery route? What is it for? Our school, our children will benefit.' So we led, I think it's two or three different staff meetings within a sequence, to introduce what the idea of mastery was, then to look at the scheme and then to begin to evaluate the impact of the scheme. So that would have been over the whole academic year. **(Maths lead, Shire)**

Curriculum schemes are thus seen to offer a tool for establishing shared practices across schools and trusts. However, these tools appeared to be more successful in some areas of practice than others. For example, several interviewees described challenges in how to develop children's reasoning, whereas other – more procedural areas, such as calculation - were seen as less problematic.

Partly in response to these issues, schools and trusts had generally adopted one of two broad approaches to developing consistency in the teaching of mathematics: a tightly prescribed and structured top-down model, or a more emergent approach that relied on collaborative planning and professional autonomy. The tightly prescribed model sought to roll out codified tools and practices through the use of scripted routines. The following quote from a school in a large regional MAT gives one example of this approach, combining multiple tools (maths scheme, defined lesson structure) with defined routines (self-evaluation, instructional coaching) to ensure consistency of practice:

So, in terms of CPD, we've kind of got a new model at the moment that we're implementing, which is based around coaching, instructional coaching... So all of those elements that should be in a good lesson or that are needed to ensure good teaching, we look at all of those elements and then the teachers have actually completed a RAG [i.e. red/amber/green - self-assessment] on themselves, so regulated themselves against all of those elements... And then we're doing a coaching approach to that. So we will come into lessons and support the teachers in improving that one area.
(Headteacher, Town)

In contrast, the second approach was less prescriptive, relying instead on teachers' professional judgement. This did not preclude the adoption of shared tools, such as a maths scheme, but these tools were used in less prescribed ways:

I think what we are all learning... is you have to take the good from whatever you see. And sometimes some people who have made those (maths) schemes may not have got it right, you know, and I think actually there needs to be some acknowledgement that teachers on the ground know that... we should be able to use that professional judgement to say 'No, that's not the right time for that'.
(Headteacher, City)

This second group of schools and trusts generally adopted routines to facilitate collaboration and joint practice development between teachers. In some cases this was explicitly aimed at co-designing and embedding shared practices and tools, thereby intentionally developing an aligned epistemic community. In other examples the collaboration was more open ended, providing opportunities for maths leads and/or class teachers to experience different contexts and approaches without defining how this learning might be applied. The following quotes, from the headteacher and maths lead in one large, maintained school illustrates how peer reviews with other schools could facilitate this more open ended approach:

We go into each other's schools in a small group, about four or five at a time, and we go in to look at whatever the head teachers have decided they want us to look at... I took (maths lead name) to one of those a couple of years ago, to look at maths in another local school. So it's sort of like helps you to see well how well am I doing against them
(Headteacher, City).

It's really helpful... it's a really good experience to be that person to go and see it in another school, like see some other lessons and it's really valuable to look other people's books.
(Maths lead, City)

In summary, schools and trusts are seeking to develop consistency in the practices, tools and routines that they adopt, although there are very different ways of working towards this, from top-down and tightly prescribed, to bottom-up and open ended. These efforts are partly aimed at addressing the lack of clarity around what mastery involves. The challenge is that as different schools and trusts develop different interpretations of mastery, each supported by its own practices, tools and routines, the scope for collaboration and learning across local areas become more difficult. These issues were alluded to by several of our interviewees, particularly those working at system levels:

The challenges we've got as well, with more schools moving in to Multi Academy Trusts, is they like to do their own in-house CPD. Uh, you know. So if you've got a... trust with, you know, six secondary schools in (locality name) they like to keep all CPD in house, you know? So you have got that shared language, that shared understanding of teaching and learning that is shared within that trust.
(System leader, Shire)

Bridging boundaries: moving knowledge around

Mel Ainscow has argued that school and system improvement requires an ability to "move knowledge around."[75] Formal and informal CPDL provides a key mechanism for this, by bringing practitioners together to generate new knowledge and to disseminate and exploit existing evidence and expertise. The new, more complex and less clearly place-based educational landscapes described so far in this report can open new spaces for collaboration and knowledge exchange. However, these changes also generate new boundaries and rifts in the landscape – for example, between schools, MATs, and hubs – potentially making it harder for school and system leaders to move knowledge around.

The sections above have illustrated how linked systems, aligned approaches to professional learning and shared practices, tools and routines all play a role in shaping local landscapes for CPDL. The research also highlighted the importance of individuals who can look beyond their immediate organizational contexts, to identify and share new knowledge, expertise and/or approaches. Paul Williams explores the role of such boundary spanners, including beyond education, arguing that they play four overlapping roles: reticulist (or network builder), interpreter/communicator, coordinator and entrepreneur.[76] These roles were apparent in different combinations across the three localities, where it was clear that different kinds of bridging activity were emerging in response to the changing landscape along with new types of bridgers who could connect different parts of the landscape.

Headteachers and subject leaders have always spanned boundaries as part of their formal roles. For example, as outlined above, maths leads attend external training and then cascade the new knowledge acquired within their school. The research revealed differences in how these school leaders operated to identify and share knowledge. Some were clearly more agentic than others in how they worked to build and sustain external connections, though this was also influenced by how long they had worked locally and the networks they had formed. This quote is from a more active maths subject lead, who works to build and sustain external networks:

I would probably go to Phil first... He used to work here so I know him really, really well and I know I can just send him an e-mail or give him a ring... He's really keen to be very supportive of all the maths leads in the primary schools. And I've also got a really good connection with someone from the maths hub... And she's also someone who I would go to for advice as well. But there's also a really good connection between us math leads, we've done so much together now. I... would feel really confident just sending them a message as well.
(Maths lead, City)

These school-based approaches were clearly shaped by the extent to which schools, MATs and other providers in each locality facilitated collaboration. As outlined above, in Shire an area-spanning heads association serves to integrate LA, hubs and, to a degree, the larger MATs that reach into the area. To make this work, a core group of system leaders sit on each other's advisory groups and boards. Some of these boundary spanners hold multiple roles, spending time in different contexts on different days of the week; for example, a leadership role within a school, an improvement role across the MAT, and a part-time role within the local hub. These boundary spanners can not only move knowledge across the landscape, they can also work to embed and reshape it in different contexts, requiring a more agentic, translational form of boundary spanning than the more conduit-like bridging required from heads and subject leaders within schools.

City does not have Shire's locality-spanning headteacher association but the density of the schooling landscape together with overlapping hub arrangements and good relationships between key individuals and organisations still enables knowledge to move around, as one maths lead explained:

I don't think we use our local area particularly, partly because I think the expertise we have within our own networks and organisation is stronger... we definitely use the fact that we are a Multi Academy Trust. We use our maths hub... there are formal forum meetings for collaboration, but it's the informal ad hoc, 'Oh, I've got a question, I'm gonna ask somebody'...those links that are created and ... just really used. (Maths lead, City)

The TSH and Maths Hub in City play an important role in facilitating these information flows, reflecting the skills of a few key local boundary spanners. Some of these individuals hold portfolio leadership roles and can draw on extensive personal networks as well as professional credibility based on playing roles in schools and across the system over many years. Other boundary spanners – such as Helen, in City - operate more commercially, drawing on their knowledge and networks to advise

pulling things through. Helen is a member of the National schools and help them to 'pull through' essential knowledge from across the wider landscape:

Helen has got her own company... and she's proved to be invaluable, because what she does is she provides different layers of training... she does a lot of reading and she's part of wider national and local groups and head teachers... So by attending her courses I've been able to keep up to date with sort of that national picture and pulling things through. Helen is a member of the National College. She's got other wider groups that she joins. She does that national stuff at that level and then she brings it back and distils it down to group of head teachers who then distil it back down into their schools.
(Headteacher, City)

So, boundary spanning individuals might draw their authority from the formal roles they hold, the organisations they represent, and/or from their own particular knowledge, networks and histories. They are able to generate and mobilise their social capital and work flexibly across and between organisations and their diverse systems and processes. They can sit and act at different levels in the system and can span in different ways. Some might simply act as a conduit for information, by attending a hub event and cascading the information to their colleagues. Some might include a translational, interfacing function, where knowledge and expertise is reworked and reapplied in new contexts. Others might filter or amplify, weaken or strengthen knowledge, and might foster networks to allow wider exchange, depending on the situation.

Critically, the work of boundary spanners both impacts and is impacted by the local landscape in which they operate. Key boundary spanners, for example those working in hubs and in senior roles in MATs, appeared to be key in shaping the coherence of the local learning landscape. Equally, the wider group of boundary spanners – such as school-based maths leads and heads – appeared more or less able to fulfil their role depending on the extent to which their local landscape encouraged or prevented the sharing of knowledge. Concerningly, we heard examples where the loss of one key boundary spanner had impacted on the wider system. For example, in Town, an established TSA led by a respected leader who was seen by many as providing 'glue' for the local CPDL system had dissolved when the TSA was de-designated and this individual moved to work elsewhere.

Sense making: a lack of strategic oversight

The research revealed various examples of sense making within individual schools. Most schools adopted routines and spaces through which this sense making could take place. For example, staff might meet together to inform annual development planning processes, in team meetings, INSET sessions, learning walks and so on. These opportunities allowed school staff to reflect, collectively, on the progress they had made and the challenges they faced, and to agree how they might work to address emerging issues, not least as a result of Covid.

At locality level there was evidence that individual MATs and to some extent wider localities, were engaged in a level of 'bottom up' sense making. For example, the following quote is from a leader in Shire, who reflects on how the MAT has enabled schools to come together to develop shared understandings of mastery, thereby avoiding reinventing the wheel in each school:

We're all little tiny cogs. So, our school was a little cog and everybody in the school was running around frantically... And nobody was getting anywhere very fast. And the school down the road was doing exactly the same. And then, as we joined the trusts, we realized - the schools that were in the trust – we're all doing exactly the same!... everybody was grasping and, sort of, struggling on their own. And I wanted to try to bring schools together in the form of, you know, bring the Multi Academy Trust together... (so) we've got this shared understanding of mastery.
(Senior teacher, Shire)

There was less evidence of strategic, ongoing sense making in relation to maths pedagogy, practice and/or CPDL across localities. Certainly, fora did exist for bringing key leaders together in all three areas: these included (Maths) Hub advisory groups, LA-convened improvement partnerships, and the various TRGs and subject networks for maths leads. In City, there was also a regional initiative underway to bring the various curriculum hub leaders together to meet periodically. This quote, from Shire, illustrates how the heads association there had facilitated a level of area-based sense-making in relation to CPDL:

[Heads association] has also been instrumental in helping head teachers to plan CPD ... the conference recently was quite successful in that it gave head teachers for the first time in two years, the opportunity to meet face to face and to say 'I'm doing this, do you want to access it?' So, for example, after that conference I'm joining up with two other schools to do some more work on behaviour and we are sharing the cost. So I would describe [the association] as a conduit to help our teachers to plan their CPD for staff.
(Headteacher, Shire)

However, there was little evidence that this joining up and sense making was taking place strategically or consistently in any of the three areas, and particularly for maths. With the demise of LAs there is no clear body or individual who has responsibility for making sense of patterns of pupil progress and attainment across a locality, or for identifying shared CPDL needs for staff across different schools. The Maths Hubs have large footprints and do not have the remit or authority to challenge a school that does not engage. Furthermore, the Hubs' remit is not primarily focused on addressing local professional development needs. One LA lead explained the lack of this local sensemaking as follows:

We don't have fairly regular conversations as local authority with the Maths Hub actually. So that's just made me reflect on, you know, Why? Why that is the case? Because if we were to be a bit more systematic and systemic in our thinking around mathematics development, surely we need to have regular meetings with the leaders of the Maths Hub in order to know which schools were engaging, what they're engaging with and what the impact of that is being. But we, I, don't have sight of those metrics if I'm honest with you.
(System leader, City)

The extent to which sense making activity should function in a holistic, systematic and comprehensive way in a locality depends on how one thinks local learning landscapes themselves should operate, and the level of co-ordination or coherence that should be present - beyond that within individual school and trust units. This question of coherence, and the implications for the equitable access to high-quality CPDL is the starting point for the synthesis of findings in the next section.

Discussion: understanding local learning landscapes

06

This final section synthesises the findings and draws out cross-cutting issues in relation to four key themes: coherence, quality, equity and leadership.

Coherence of professional learning

Throughout the report, we have argued that the broad thrust of policy in England since 2010 has been towards fragmentation and reformation in both school structures and provision for CPDL, but that this process of reformation remains incomplete. Section 2 explained that coherence – or alignment – is important across school systems if schools and teachers are to have clarity on the professional learning required for success and on the career-long support available to achieve this. However, this can be hard to achieve in large, complex and evolving systems such as England, in particular now that schools have been granted greater autonomy and traditional, place-based coordination by LAs has been rolled back. Section 3 drew attention to the literature on place, highlighting how conceptions of 'local' are not fixed, but rather they change over time and depending on the perspective of the observer. Section 4 illustrated these issues from the research, showing how different individuals, schools, MATs, hubs and networks offered different interpretations of 'local', often holding multiple perspectives simultaneously. Any discussion of coherence must be understood in relation to these points. Just as what constitutes 'local' will depend on the perspective of the individual or organization, the same is true of 'coherence'. Nevertheless, a clear finding from this research is that the CPDL offer across all three localities is experienced as fragmented - or incoherent - by a majority of headteachers, maths leads and teachers in schools.

In simple terms, coherence here might be understood as 'well-coordinated', with a clear CPDL offer that all schools can access. However, the research revealed a more nuanced set of conditions for coherence to be experienced in practice, including coherence across subject and pedagogical practice, coherence with intrinsic forms of personal and professional growth, and coherence over time, throughout a teacher's career. This indicates the need for highly sophisticated CPDL frameworks which integrate with workplace cultures to enable formal and informal professional learning which is mutually reinforcing in ways which support cumulative growth over time.

In this section, we focus on the nature of coherence at the scale of the three localities: City, Town and Shire. Each local learning landscape has its own history of structures, relationships and practices, as discussed throughout the report. This means that different models for pursuing coherence are more or less feasible. Shire, for example, is striving to build coherence through its local headteacher network, a hybrid of an old LA model of geographically-bounded local administrative coordination but now incorporating new structures (e.g. Hubs) even though they cross locality boundaries. City, on the other hand, has moved further from the LA model and here coherence has developed – whether by accident or design – by virtue of the co-location of leading organisations that help to align some of the work of hubs, trusts and other networks. Town is essentially balkanized, with several border-crossing MATs driving their own distinctive versions of internal coherence, while rapidly dissolving LA systems and the loss of a well-regarded TSA have left a coordination vacuum for schools outside these MATs.

The extent to which these varied attempts at coherence are working is moot; there are reported strengths and weaknesses in each model, depending upon the position and perspective of participants. Indeed, connectivity, engagement and consistency remained challenging in all three areas, albeit in different ways. City's model is complex and multi-level, dominated by a small number of established players, while a minority of schools have chosen not to engage with the Maths Hub despite its strong reputation, partly out of a view that MAT-provided CPDL is "not for schools like ours". Shire's partnership structure is inclusive, with few dominant players and less risk of school isolation, but it is mainly focused on information-sharing and remains fragile; reliant on commitment and funding from school leaders at a time when budgets are increasingly tight. Schools within MATs in Town may be well-served but many schools are not and the lack of locality wide alignment across hubs, MATs and the LA creates serious risks of isolation and confusion.

Many stakeholders within these fragmented local learning landscapes are working hard to develop some semblance of coherence within their patch, whether that be a school, Hub, MAT or wider network. There is plenty of evidence of coherence within MATs, though this is unsurprising given that this is part of their raison d'etre. That does not lead, however, to coherence between MATs, even though they might serve the children of the same locality, town, or even family. Furthermore, MATs have very different characters and cultures, and accordingly different notions of coherence. Some enact coherence in a top-down, hierarchical way, through standardized processes and aligned schemes of work, backed by mandatory CPDL designed to implement and reinforce these approaches. In others, trust schools

are more autonomous, organised in flatter, more federated ways where the pursuit of coherence is more co-designed or organic. The role of the maths lead varies in two such MATs, one being more about coherence through control and consistency and the other as coherence through dialogue and consensus, focused on reflective (leadership) practice and sense-making rather than assumptions about 'what works' irrespective of context. These reflect different sets of theories, language and tools, resulting in different kinds of epistemic community and, it seems, approaches to teaching mathematics.

Quality of professional learning

Interviewees were asked what they saw as high-quality professional learning. Responses were broadly consistent across different groups:

- first, high quality CPDL achieves impact - "the endpoint is always the children and young people - the endpoint is not teachers"
- second, it is adapted to the context of the school or classroom - "it's got to meet the needs of the school, 'cause otherwise it's not going to have any impact"
- third, it is iterative and sustained - "drip, drip, drip"
- fourth, it connects to the real needs of teachers in ways that challenge thinking as well as changing practice - "it's the stuff you keep going back to, and that reminds you of why you're there in the first place, but also challenges you to think differently and then put those actions into place"
- fifth, it involves structured collaboration - "it's the fact that there's a responsibility to come back together and sort of report back on how it's done, how it's going, or to observe each other".

Continuous improvement requires leaders in schools who have the time, confidence and reflective capacity to recognize where and how they and their staff could improve, how appropriate external expertise could support that improvement, and what they should do to achieve that in practice.

Maths Hub leaders could articulate clearly how the TRGs and programmes were designed to reflect these features, but sometimes bemoaned the fact that "*people generally think CPD is going on course so, so that's the first thing that we have to dispel*" (Maths Hub Lead).

Sections 4 and 5 introduced various examples of how CPDL is structured and experienced in different schools, MATs, networks and localities. These examples reveal both points of similarity as well as wide variations in how CPDL operates across these different contexts. The most consistent point of similarity was the role of the school maths lead, who invariably plays a role in attending external courses, networks and events and then in cascading the learning to their colleagues back in school, most often via INSET sessions. Most maths leads augment this cascade role with additional activities, such as learning walks, book looks or individual coaching, aimed at embedding desired practices. The level of support provided to maths leads in undertaking this role varied widely, depending on the level of engagement in maths-related issues by the headteacher, the size of the school (for example, some larger schools had two maths leads working together, while very small schools sometimes struggled to release their maths lead to attend external training), whether or not they worked within a MAT that employs a maths subject specialist, and the extent to which they had access to peer networks and models of good practice in their locality. This research was not designed to assess the effectiveness of this model of primary school subject leadership and cascade CPDL, but we consider it worthy of further study.

Turning to some of the main points of difference in how CPDL was structured and experienced, some of the common variables are alluded to above, including school size and MAT membership. However, while these structural features were significant, they did not determine CPDL quality. We visited small schools with rich professional learning cultures and large schools in which the approach appeared narrow or formulaic. Similarly, as outlined above, MATs adopt very different approaches to CPDL in line with their wider ethos and improvement approach, whether standardized, co-designed or organic. Equally, several of the LA maintained schools visited were offering vibrant, high quality CPDL for their staff (although this rarely drew on LA-provided programmes).

This suggests that coherence and quality in CPDL is about far more than whether courses are available and well signposted to schools, or even whether those courses are well-designed and reflect a solid evidence-base. Such considerations are undoubtedly important, but they will only achieve impact if all schools engage and if all schools can embed the learning in ways that support continuous improvement. This requires leaders in schools who have the time, confidence and reflective capacity to recognize where and how they and their staff could improve, how appropriate external expertise could support that improvement, and what they should do to achieve that in practice.

This leads to an unsurprising conclusion that a key determinant of CPDL quality for teachers is the quality of leadership. This leadership comes, first and foremost, from headteachers and maths leads in schools. However, what may be surprising is that this leadership requires far more than an internal focus on instructional issues – it is equally dependent on leaders looking outwards and operating as boundary spanners who can introduce new ways of thinking and working into the school. In addition, this requires leaders to be demanding customers of CPDL – commissioners of high quality provision.

Such outward facing leadership is clearly influenced by the wider structures and cultures within which leaders operate – i.e. the local learning landscape. Where heads and maths leads are exposed to high quality CPDL themselves, where they have opportunities to visit and learn from maths practice in other schools, and where they are encouraged to think deeply about how new maths knowledge and expertise can best be introduced to their colleagues in school in ways that make a difference to pupils, then the chances that all staff in that school will have access to high quality maths CPDL are increased.[d] Where schools become isolated – by choice, or because the local framework excludes them – then the scope for high quality CPDL is reduced. None of the three localities has this cracked: Shire is arguably more inclusive, but it lacks the vibrancy and flows of ideas apparent in City, while Town risks becoming ever more balkanized over time if the hubs cannot engage key MATs and if staff and expertise become locked up in silos. We return to the issue of leadership of CPDL at the end of this section.

[d]It seems likely that such approaches will work in similar ways across other curriculum subject areas, although the presence or absence of a dedicated subject hub will influence how this operates.

Equity and professional learning

Equity is often compared with equality, where equality - in this context - would assume that all schools should receive the same CPDL offer, whereas an equity perspective acknowledges that some schools face greater challenges and so require additional support. This report has highlighted some of the additional challenges that schools can face in relation to CPDL, whether as a result of their context (e.g. levels of deprivation) or the practical barriers they face in accessing opportunities (e.g. small schools, geographic isolation etc.).

The government's investment in hubs and the 'golden thread' is an attempt to address these issues and to ensure equality in the CPDL offer. This effort is significant and the research revealed numerous examples of how it is helping to ensure that teachers and schools do access high quality CPDL. As described in Section 3, a majority of case study schools had accessed Maths Hub programmes and resources, and there was also widespread engagement with Teaching Hubs, Research Schools, English Hubs and so on. This engagement included many schools in more deprived contexts as well as some of the small and remote schools visited. The fact that these opportunities are offered 'free' was widely welcomed by schools. Many schools and teachers had also drawn on other sources of CPDL, some of which could be seen as part of the national offer (e.g. Chartered College of Teaching, NCETM) or as commercial-but-partly-publicly-funded (e.g. White Rose). Nevertheless, despite this national offer, this report has revealed stark inequalities between schools and teachers in terms of the types and scale of CPDL opportunities they access as well as between the three local areas studied.

Maths Hubs, and equivalent policy-designated hub providers, offer extensive opportunities for teacher learning, but this strategy has limitations when viewed through the lens of equity across local learning landscapes. This is not to criticize the work that Hubs do – the schools that engage with them are overwhelmingly positive - but to note that they are constrained by what can be offered, and by limitations to access for a variety of reasons. In part this relates to the flexibility of the model: at the inception of the Maths Hubs, the notion that they should be responsive to local CPDL needs was present, though this evolved to become a more controlled agenda. Another issue is the sheer size of the Maths Hub footprints (~500 schools) compared to the resources available (not forgetting that this work is generally undertaken by schools and leaders who are also busy providing education themselves). Given this scale, it was clear that Hubs needed time and capacity to build and sustain distributed networks: for example, through the designation and deployment of 'local leaders of maths education' based in partner schools. Comparing the three localities it seemed that the two hubs based outside the immediate area studied had found it harder to engage geographically distant schools, although in Shire the support of the local headteacher network had facilitated stronger engagement than in Town.

Ultimately, school and MAT leaders can choose whether or not to engage with a hub. This means that access for teachers is largely dependent on the extent to which their school is 'outward facing', but does not mean that non-Hub-engaged schools and leaders are necessarily deficient. Schools choose not to engage for a variety of reasons, including a view that the Hub provision is "not right for us" or that maths is not currently a priority for CPDL across the school. In some of our cases, albeit a small number, headteachers and MAT leaders didn't know about the local Hub, considered it too remote, or simply did not value its programmes more highly than what they thought they could provide themselves. Equally, we heard from system leaders that certain schools were simply not in a position to engage with hubs; for example, because the school lacked leadership capacity and faced more fundamental improvement challenges that made external CPDL inappropriate. System leader interviewees responsible for hubs and research schools were acutely aware of these engagement and equity issues and were working to overcome them where possible. For example, one MAT CEO responsible for a Teaching School Hub explained: "I've always been a strong believer that there's the haves and the have nots and I'm always a strong advocate of those on the have not side".

A more general point about the growing tower of Hubs is that headteachers have to navigate a bewildering mixture of remits and footprints, potentially explaining the consistent finding that local landscapes are seen as fragmented. There is no local one-stop-shop and this necessarily has implications for teachers' equitable access to high quality CPD. The three localities included senior bridgers who were attempting to coordinate and signpost between different offers but, as discussed elsewhere, they did not have the legitimacy to achieve this comprehensively in the face of continuing rapid change.

Stepping back, a key equity question for policy on hubs is to determine how their free horizontal offer to all schools is meant to integrate with the CPDL responsibilities of vertically structured MATs? As MATs grow and become established there is a clear move to offer more 'in house' CPDL. While some MATs see this as part of a portfolio offer which also includes external provision, from the Maths Hub and other sources, others are more tightly bounded. Several of the large MATs interviewed and visited not only offered CPDL internally, but were also involved in selling courses externally to generate income:

We work as a research school. We've got the capacity to provide that training, you know, and it's all based on the EEF guidance reports. So as a MAT, you know, we're in a fantastic position where we've got the expertise within the MAT. But we also provide that across the area, so we have lots of schools outside our MAT joining, you know, our training. Uh, which obviously, you know, it worked 'cause it's a money generator for the multi-academy trust, the research school, um, and that builds that capacity then. (Research school lead)

Given that not all schools are part of such MATs, this presents systemic equity risks – encouraging a model of 'winners and losers' (or "haves and have nots" in the words of the above CEO) in which some schools have access to additional income and opportunities than others, purely by dint of the structures they operate in.

Finally, for some teachers in the study, access to online networks provided a valued professional community. Facebook groups and the like may be open to all, but in reality two teachers in adjacent classrooms can have very different experiences of such virtual CPDL environments. Similarly, the pandemic-inspired move to online CPDL democratised access, but questions remain about quality, impact and whether these approaches will stand the test of time. So, whilst there are tremendous opportunities emerging through new social media networks and online platforms, the question of who is accessing what, and what they are getting from it, is difficult to ascertain. It seems clear that technology is not the great leveller – in terms of CPDL equity – but merely another dimension of what is already a complex CPDL landscape.

Locality leadership for professional learning

In addition to the overarching research question introduced in Section 1, the study focused on more specific questions relating to the leadership of CPDL at policy and system level. These included how school and system leaders could create the conditions for effective professional learning for all teachers and the role of collaboration in building and sharing knowledge and expertise across the system. We set out many relevant findings on these questions above and in previous sections. This includes the observation that outward facing headteachers and maths leads play an essential role in ensuring CPDL quality within schools, and that the nature of the local learning landscape within which these leaders work will shape their appetite and ability to do this well. Some localities and networks appear more successful than others in creating the conditions for outward-facing leadership and at moving knowledge around. In this final section we focus on the role of system leaders and leadership in enabling this. At risk of extending the landscape metaphor too far, we suggest that these leaders should be seen as *landscape gardeners.*

> Some localities and networks appear more successful than others in creating the conditions for outward-facing leadership and at moving knowledge around.

The research shows clearly how policy has worked to 'rescale' education in England, through the roll-back of LAs and the development of a variety of new scales (Regional Directors, sub-regional hubs, non-place-based MATs etc.) alongside strengthened national oversight and control. In Section 5 we explored how teachers' identities were gradually shifting over time, for example as they moved from an LA to a MAT scale. In this context, system leaders are faced with the question of whether and how to promote a particular local version of scale, as a way to strengthen local commitment, collaboration and, potentially, coherence. In Shire, the continuing presence of the LA together with the decision by headteachers to 'spin out' their network into a fee-paying membership association had provided a means to sustain local allegiances, despite around half of the schools also joining MATs. In City, the decision by local system leaders to design in collaboration between the Maths and Teaching School Hubs had enabled a less consistent but still meaningful local scale and identity. In contrast, the reduced LA role and loss of the local TSA in Town, coupled with the arrival of multiple non-local MATs, had disrupted local commitments.

Whether and how leaders choose to maintain a local identity and scale shapes their response to the other elements of the conceptual framework. For example, where local commitment remains strong, it becomes more important and feasible to link systems together. Once established, these linked systems then serve to reinforce the importance of the local scale, creating positive feedback loops and a snowball effect: for example, in Shire, rather than working independently, the new curriculum hubs gained access to local schools via the heads association. These snowball processes appear to contribute to coherence, quality and equity in the ways outlined above.

Unpicking the role of key system leaders in these processes is challenging. Local allegiance in Shire is clearly about more than one or two individuals, but it is also apparent that the credibility and boundary spanning skills of the chair of the heads association is critical in holding the arrangements together. In City, MAT and hub leaders have not only established the core model but are working to adapt it so it remains inclusive and responsive to the needs of schools; for example, by commissioning a well-regarded boundary spanner to engage the former TSAs in designing a local CPDL offer.

System leadership research and policy in England over the past 15 years has tended to focus on the model of school-to-school support, where a high performing school and leader provide support to another school that is struggling. This has led to a somewhat narrow interpretation of system leaders as conduits, experts who can stimulate turnaround and transfer practice from one context to another.[77] This model has also shaped understanding of the MAT CEO role, which is commonly seen to require school turn-around and system leadership experience.[78]

Arguably, the research presented here indicates a broader understanding of system leadership. The most impressive local system leaders identified here played demanding roles, which included shaping a local identity (through 'scalecraft')[79] and the four boundary spanning competencies identified by Williams, i.e. network builder, interpreter/communicator, coordinator and entrepreneur.[80] Another core skill was the ability to design and run high quality professional development programmes which could be adapted across different schools, trusts and contexts. These leaders had built their credibility and skills to fulfil these roles over many years, generally, it seemed, without any formal training to equip them. Importantly, even now, many of these leaders did not hold consistent designations or clearly defined roles and, from the outside, they could appear relatively invisible. This may explain why such leadership appears fragile and inconsistent across the three localities, and why it was allowed to disappear in Town.

Some of these local system leaders played senior roles in MATs. These leaders stood out because of their ability to see the big picture and their professional generosity, working in ways which facilitated coherence within their trust while also enabling member schools to work responsively, as part of diverse local learning landscapes. This approach was not always straightforward, as this MAT-based Maths Hub lead explained:

> We're not a trust where we say 'everything is standardized'... and we've actually struggled a bit to get our own [MAT name] schools to engage with our own Maths Hub... And that's an interesting journey... what happens is that some who have got good head space and are doing really well... they engage... and they lift even further. And it's the ones who could really do with being involved in a structured program who maybe think they just haven't got the capacity 'cause they're just firefighting.

Finally, two areas of the conceptual framework appeared weaker in all three localities, perhaps indicating areas where system leadership roles and capabilities could be usefully strengthened:

- First, epistemic communities: Maths Hubs have adopted consistent approaches and this has – to some extent - encouraged the adoption of shared practices, tools and routines for the development of Teaching for Mastery among schools that engage with the hubs. Furthermore, a small number of commercial schemes, such as White Rose, have been adopted by many schools (albeit in different ways and to different extents). Where schools engaged with these shared approaches it appeared to support an enriched level of dialogue and collaboration in relation to mathematics pedagogy and CPDL, including across local MAT and school boundaries. However, this was far from universal and it was clear that some schools and MATs either felt their own approach was preferable (sometimes for commercial proprietary reasons) or remained isolated from these wider discussions.
- Second, sense making: as we note in Section 5, this was weaker across all three localities. Part of the issue here was the lack of defined roles and responsibilities for oversight across localities, meaning that no individual or group had responsibility for analysing data and convening the discussion. Maths Hubs were expected to develop annual plans and could apply to undertake innovation projects. Nevertheless, the lack of any broader discussion of curriculum-wide strengths and areas of development, or for how such an analysis might inform locally responsive CPDL efforts, appeared to be a significant gap in the current framework.

Conclusion

A clear finding from this research is that the CPDL offer across all three localities is experienced as fragmented - or incoherent – by most primary schools. However, the level and nature of this incoherence differed widely between the three localities, with important implications for quality and equity. Our findings suggest that recent policy-driven efforts to reform the CPDL framework, aiming to ensure national consistency and coverage, will not succeed unless attention is paid to the nature and implications of diverse local learning landscapes.

Drawing out specific recommendations is challenging given the complexity of the issues, and there are limits to what can be inferred from a study of primary mathematics CPDL in three localities. Nevertheless, four questions emerge, with associated implications for coherence, quality and equity.

How can headteachers and subject leaders be supported to become more outward facing in their approach to CPDL?

The research highlighted the importance of maths leads and headteachers being outward-facing, well-networked 'boundary spanners' who access relevant external knowledge and expertise and use this to enrich the professional learning of colleagues within their school. However, the extent to which this happened differed widely.

This indicates a need to strengthen support for outward facing leadership, for example by including locality examples in the new Leading Teacher Development NPQ and by establishing an expectation that primary subject leaders should have access to local curriculum networks.

How can the roles played by local CPDL system leaders be recognised, rewarded and strengthened?

The research highlighted the role played by a small and somewhat disparate group of local CPDL system leaders – the landscape gardeners.

Current system leadership policy focuses almost exclusively on MAT CEOs, who are highly paid and have access to various forms of CPDL. Local CPDL system leaders arguably require equivalent recognition and support across every locality in England.

How should curriculum hubs integrate with MATs?

Hubs currently provide a 'horizontal' CPDL offer which is free, local and universal. Meanwhile, MATs have a 'vertical' responsibility to secure CPDL across the schools they operate.

If the aim is for a national CPDL entitlement and strong local learning landscapes, then there should be clear expectations for all MATs to engage with their local hub/s and with other local trusts. Conversely, if MATs are seen to be self-sufficient 'vertical' CPDL silos, then hubs could perhaps be given a remit to focus on engaging the many schools that are not in trusts (although this would not address the balkanisation issue).

A related issue is who should operate the hubs, given the finding that MAT-run hubs can create unfortunate local dynamics. We note that in some subjects, hubs and networks have emerged across wider organisations, such as universities and museums. Whatever the model, there is a need for significant and sustained investment if hubs are to achieve meaningful impact.

Who, if anyone, could or should have responsibility for the coherence of CPDL across a locality?

A more concerted focus on ways to strengthen local learning landscapes is needed. England's current framework is at odds with the approach in high performing systems worldwide.

However, we found little agreement on how local CPDL landscapes 'should' be developed, even among policy makers and experienced system leaders. One view might be that all schools should join a 'strong' MAT, but this would not address the risks associated with balkanization and knowledge silos. A second option might be to rationalize the landscape, for example by co-locating the various hubs into singular sub-regional bodies, but this would risk disrupting the existing subject-specific networks and sources of expertise that have developed. A third view might be that the existing reforms simply need more time to bed in, but the evidence presented here of divergent local dynamics and significant equity and quality issues makes this seem unlikely.

Ultimately, it may be that local coherence in CPDL will be dependent on a wider set of changes to how local schooling arrangements are governed. For example, could locality partnerships be developed in all areas, building on existing examples such as Camden Learning, Learn Sheffield and Surrey's SAfE? Could DfE Regional Directors work with LAs to strengthen locality oversight of schooling, for example through the publication of dashboards which track key indicators in relation to the recruitment, development and retention of staff; levels of inclusion and exclusion; and school and pupil performance? Could Ofsted be tasked with undertaking local area inspections of CPDL provision and impact, in the way that it did previously for 14-19 provision?

Whatever the mechanisms selected, the priority should be to strengthen local CPDL coherence, quality and equity given the evidence that this will enhance teacher and pupil outcomes.

Appendices:

A. Methodology

Section 1 of this report outlines the project research questions. The research focused on 'local learning landscapes' for continuing professional development and learning (CPDL) for teachers in England in the area of primary mathematics. Specifying a phase and subject area provided practical boundaries for the research given the diverse and dynamic nature of CPDL for educators.

Ethical approval was secured at the project outset from the University of Nottingham School of Education Research Ethics Committee. Interviewees gave informed consent to participate, with the localities, schools and interviewees all anonymised.

The project Advisory Group (see 'About the project' for membership) met five times over the course of the research. These meetings provided important opportunities to discuss and develop the conceptual framework, the research design and sample, and the emerging findings and conclusions.

The research involved four phases of work:

1) a literature review and development of a conceptual framework for 'local learning landscapes' (see Section 3)

2) the selection of three localities for study

3) sampling and data collection within localities; and

4) a thematic analysis of qualitative data using the initial conceptual framework.

Developing the Conceptual Framework

- Understanding Place
- Networking Professionals
- Making Sense of Complexity
- Ensuring Learning

Selection of Localities

- South, Midlands, and North
- City, Town, Shire
- Area Encompassing 60 Primary Schools

Sampling and Data Collection within Localities

- 82 Interviews Across the 3 Localities
- 6-8 System Leaders
- 10% Schools in the Locality
- School Leaders, Maths Subject Leads, and Classroom Teachers

Thematic Analysis of Qualitative Data

- 3-tier Codebook using NVivo
- Derived from the Conceptual Framework for Local Learning Landscapes

Selection of localities

Three localities were selected as research sites. The research team, in consultation with the project Advisory Group, selected three localities that were broadly representative of the geographic and socioeconomic diversity which exists across England. One locality is in the South, another in the Midlands, and a third is in the North of England, with a reasonable spread in terms of levels of deprivation and ethnic diversity. One locality is within a city, another is a town, and the third – shire – includes a mix of rural villages and more densely populated centres.

Local Authority boundaries were considered when defining each locality – City and Shire are both sub-areas within an LA, while Town represents an entire LA area. Each locality sits within an LA area encompassing around 100 primary schools, making them smaller than a Maths Hub region. Given differences in population density and school proximity, the area of each locality varies, with city being the smallest and shire having the most expansive geographical footprint.

We also sought variation in the location of the Maths Hub (i.e. within the study area or external) and in levels of primary school engagement with these Hubs (i.e. above and below average).

Sampling and data collection within localities

The research team engaged with a diverse range of stakeholders in each locality to learn about the 'local learning landscape' in respect to CPDL for primary mathematics. In total, 82 interviews were conducted across the three localities. In each locality, we interviewed system leaders, school leaders (Headteachers and Deputy Headteachers), maths subject leads, and classroom teachers.

We first engaged with system leaders who had knowledge of the local CPDL landscape. A system leader here refers to an individual with a professional remit beyond a single school. Between December 2021 and March 2022, 6-8 system leaders were interviewed in each locality (online, via MS Teams). Sampling involved a mixture of purposive and snowball strategies. Initially we contacted leaders with the following roles in each locality: Maths Hub lead, Teaching School Hub lead, Research School lead, LA education lead, Ofsted Regional Director, and DfE Regional Schools Commissioner (or their representative). In a small number of cases these interviewees were unavailable or declined to be interviewed. During these interviews we asked for suggestions of other local system leaders who could offer insights on the issues studied, which led to additional locality-specific interviews, including with MAT CEOs, former Teaching School Alliance leads, and other local system informants.

We then selected a sample of schools within each locality, based on an analysis of nationally available data on school characteristics and performance levels, Maths Hub engagement data (supplied by Maths Hub leads) and insights from the system leader interviews. The resulting sample of 6-7 schools sought to ensure a representative range of contexts, including: school size (pupil enrolment numbers); school demographics (levels of children in receipt of Free School Meals, English as an Additional Language); school governance (e.g., LA maintained or academy, different types and size of MAT); religious affiliation; performance levels (e.g., Key Stage 2 2019 outcomes, Ofsted grade); and engagement with the regional Maths Hub (engaged/non-engaged).

Headteachers of selected schools were approached and invited to participate, completing a school-level consent form. Where schools declined to participate or did not respond, alternative schools with equivalent characteristics were approached. The achieved sample of each locality is shown in Tables A.1-A.3.

City School Sample

Table A.1:

	School 1	School 2	School 3	School 4	School 5	School 6
School Description	Split site (2 form) primary in regional MAT that leads Teaching School Hub	Large primary (3 form) in a regional MAT that operates Maths Hub	Large Primary (3 form) that is LA maintained	Large (3 form) split site primary that is LA maintained	Average size (1 form) VA/VC/ faith academy converter (SAT)	New build (2 form) primary in regional MAT
Pupil Enrolment	301-400 pupils aged 3-11 years	401-500+ pupils aged 3-11 years	401-500+ pupils aged 4-11 years	401-500+ pupils aged 4-11 years	201-300 pupils aged 4-11 years	201-300 pupils aged 4-11 years
FSM/EAL	FSM: 40-50% EAL: 70-80%	FSM: 10-20% EAL: 30-40%	FSM: 10-20% EAL: <10%	FSM: 20-30% EAL: 10-20%	FSM: <10% EAL: 50-60%	FSM: 20-30% EAL: 30-40%
Maths Achievement (KS2 average)	Local: below National: below	Local: average National: below	Local: above National: above	Local: average National: average	Local: above National: above	Local: N/A National: N/A
Ofsted Rating	3	2	1	2	1	2

Town School Sample

Table A.2:

	School 1	School 2	School 3	School 4	School 5	School 6
School Description	Large primary academy in a medium-sized local MAT	Large Local Authority maintained primary school	Average-sized primary academy in a large cross-regional MAT	Average-sized infant academy in a large cross-regional MAT	Large primary in a large cross-regional MAT	Large Local Authority maintained primary school
Pupil Enrolment	401-500 pupils aged 3-11 years	301-400 pupils aged 3-11 years	201-300 pupils aged 4-11 years	201-300 pupils aged 2-7 years	401-500 pupils aged 3-11 years	201-300 pupils aged 3-11 years
FSM/EAL	FSM: 30-40% EAL: 20-30%	FSM: 10-20% EAL: <10%	FSM: 30-40% EAL: <10%	FSM: 40-50% EAL: 10-20%	FSM: 40-50% EAL: <10%	FSM: 50-60% EAL: <10%
Maths Achievement (KS2 average)	Local: below National: below	Local: average National: below	Local: above National: above	Local: N/A National: N/A	Local: below National: below	Local: average National: below
Ofsted Rating	3	2	2	2	4	2

Shire School Sample

Table A.3:

	School 1	School 2	School 3	School 4	School 5	School 6	School 7
School Description	Large (3 form) Catholic school in a diverse town centre-voluntary aided	Smallpri-mary, Local Authority maintained located in rural area	Medium sized primary, member of a small local MAT	Medium sized pri-mary in a diverse town centre, Local Authority maintained	Rapidly growing academy, part of a large cross-regional MAT, located in small village	Small CofE school, Local Authority maintained	Small academy in a medium-sized regional MAT
Pupil Enrolment	401-500+ pupils aged 3-11 years	<200 pupils aged 4-11 years	401-500+ pupils aged 2-11 years	401-500+ pupils aged 2-7 years	401-500+ pupils aged 3-11 years	<200 pupils aged 3-11 years	<200 pupils aged 2-11 years
FSM/EAL	FSM: 10-20% EAL: 30-40%	FSM: 20-30% EAL: <10%	FSM: 30-40% EAL: 10-20%	FSM: 20-30% EAL: 20-30%	FSM: 10-20% EAL: N/A	FSM: <10% EAL: <10%	FSM: 30-40% EAL: <10%
Maths Achievement (KS2 average)	Local: below National: below	Local: average National: average	Local: average National: average	Local: N/A National: N/A	Local: N/A National: N/A	Local: average National: average	Local: average National: average
Ofsted Rating	2	2	1	3	2	2	2

At each school, a minimum of three interviews were conducted: one with a school leader (Headteacher or Deputy Headteacher), another with the Maths Subject Lead, and a third interview with another classroom teacher. Most interviews were conducted in person, during the summer term 2022, with a small number conducted via MS Teams.

Separate semi-structured interview schedules were developed and piloted for each of the four different groups (system leaders, school leaders, Maths Leads, and classroom teacher). These interviews covered five subject areas: professional background and experiences of CPDL, CPDL within your locality/MAT, the local CPDL landscape (general), the local CPDL landscape (maths), final comments. In the final section interviewees were asked to provide feedback on the draft project conceptual framework, which was shared in advance as a one-page infographic. Interviews lasted between 30 minutes and one hour and were recorded.

At the end of the summer term 2022 we held a workshop in each locality. All system leader and school-based interviewees were invited to attend. In City and Town these workshops were held in person, while in Shire (due to the longer travel times involved) it was held online. The workshops provided an opportunity to 'play back' and validate emerging headlines from the research and to discuss cross-cutting themes and recommendations for change.

Thematic analysis

The research team conducted a thematic analysis of the interview data. All interviews were transcribed and then coded using Nvivo. A three-tier code book (Table A.5) was developed by the research team, based on the project conceptual framework. Level 1 codes were higher order categories directly from the conceptual framework. Level 2 codes reflected key terms that embodied the higher order categories. Level 3 codes were examples for coders to search for within transcripts. Text was primarily coded using Level 2 codes. Two members of the research team coded the data, with multiple, iterative sessions involving the full research team providing opportunities to check and validate the emerging themes and findings. Various interim outputs were produced as part of this process, including locality overviews and detailed tables comparing key features of each locality. These interim outputs were shared and discussed with the Advisory Group and at the locality workshops in summer 2022, all of which supported the analysis in this report.

Codebook

Table A.5:

Level 1	Level 2	Level 3
National context	Fragmentation Accountability Hierarchy Markets Policy	 Ofsted ECF Golden Thread NPQ OA
Local area	Reformation Regional	
Many linked systems	Providers	Edubusiness LA MAT Maths Hub Research School Teaching School TSH
	Activities	Formal Informal
Professional Learning	Formal	Training Cascade Subject knowledge Pedagogic
	Informal	Social media Conversations
	Quality	
Practices and Routines		S2S Support Community of Practice Action Research Coaching Moderation
Engagement		
Shared Tools	Maths schemes	
Sense Making		
Boundary Spanners	Modes	Bridging brokering

B. Glossary

APH	Association of Primary Heads (Shire)
AST	Academy of Singapore Teachers
CEO	Chief Executive Officer
CPD	Continuing Professional Development
CPDL	Continuing Professional Development and Learning
DfE	Department for Education
ECF	Early Career Framework
ECT	Early Career Teacher
EEF	Education Endowment Foundation
EIA	Education Investment Area
HMI	His Majesty's Inspector
ITT/ITE	Initial Teacher Training/Education
LA	Local Authority
LLL	Local Learning Landscape
MAT	Multi Academy Trust
NCETM	National Centre for Excellence in Teaching Mathematics
NLC	Networked Learning Communities
NLE	National Leader of Education
NPQ	National Professional Qualification
NQT	Newly Qualified Teacher
PD	Professional Development
PLC	Professional Learning Communities
RSC	Regional Schools Commissioner
SAT	Single Academy Trust
SLE	Specialist Leader of Education
TA	Teaching Assistant
TfM	Teaching for Mastery
TLLM	Teach Less Learn More
TRG	Teacher Research Group
TSA	Teaching School Alliance
TSH	Teaching School Hub
TSLN	Thinking Skills Learning Nation
VA	Voluntary Aided (school)

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