SCHOOLS' RATIONALES FOR DECISION-MAKING IN SELECTING PRIMARY MATHEMATICS CURRICULUM RESOURCES IN ENGLAND

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In England, in contrast with jurisdictions where textbook use may be mandated, schools choose their mathematics curriculum resources. Following a government initiative promoting 'mastery-style' mathematics textbook schemes, in this paper we analyse interviews with 12 mathematics subject leaders to examine reasons for schools' resourcing decisions. Drawing on an existing model of teachers' interactions with curriculum materials, we identify two distinct pathways of mathematics curriculum resource decision-making, contingent on schools' institutional context and perceived priorities and underpinned by high levels of professional reflection.

INTRODUCTION

This paper examines the rationales underpinning mathematics curriculum resourcing decisions of subject and school leaders in English primary (age 5-11) schools.

Whilst internationally, a textbook may be considered "a fundamental tool" in the learning and teaching of mathematics (Parra-Fica et al., 2024, p. 1), the English context stands apart from many jurisdictions. In England, schools have autonomy in how to resource their mathematics curriculum; historically, this has resulted in a relatively limited use of mathematics textbooks. Indeed, Mullis et al. (2008) found that whilst internationally 65% of 4th grade (age 9-10) teachers reported using textbooks as primary sources, in England this figure was just 15%.

The project from which this paper is drawn (Marks et al., 2023), mapped the landscape of the use of textbooks, schemes and other mathematics curriculum resources in England within the context of a government funding initiative (Department for Education [DfE], 2016) and the drive to give primary schools access to "the south Asian 'mastery' approach to teaching maths […] supported by the use of high-quality textbooks" (DfE, 2016, n.p.).

Marks et al.'s (2023) project generated data via a nationwide mixed-methods survey of primary teachers who lead mathematics in their schools, (mathematics subject leaders, MSLs), a subsidiary nationwide quantitative teacher survey and semi-structured interviews with MSLs. In this paper we report on data arising from the semi-structured interviews with reference to key outcomes of the mixed-methods survey.

Drawing on Marks et al. (2023), we use the following terms. A *mathematics scheme* is a published resource, with or without a physical textbook, written to support the

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teaching of the full primary curriculum without the need for supplementation. *Curriculum resources* thus include mathematics schemes and other resources linked to curriculum delivery, e.g. workbooks, worksheets, and teaching materials.

LITERATURE

In English primary schools, the historic low rate of textbook use (Mullis et al., 2008) reflects, in part, a longstanding antipathy towards textbooks with concern expressed that their use may render the teacher's role to that of "technician" (Boyd & Ash, 2018, p. 221) whose function is only to deliver prepared lessons. This is accompanied by fears of loss of autonomy (Gear, 2022). Furthermore, evaluations of previously available textbooks identify a "restricted and impoverished diet" (Haggarty & Pepin, 2002, p. 584) focusing on development of fluency via drill and practice tasks, with little focus on mathematical language and the development of investigative thinking.

Following a national funding initiative (DfE, 2016) to introduce mastery-style textbook schemes into English primary schools, Marks et al. (2023) updated schools' reported resourcing of their mathematics curriculum (Table 1):

Schools' Resourcing Approach	% of Schools
Curriculum resources sourced from variety of places	46
One scheme (with/without physical textbook) used exclusively	3
One scheme (with/without physical textbook) mainly used with supplementation	51

Table 1: Schools' resourcing of mathematics curriculum in England

Whilst variability in schools' resourcing decisions remains evident, the data presented (Table 1) indicates an increase in the use of textbook schemes in England from the figure reported by Mullis et al. (2008). Marks et al. (2023) found that hybridity in textbook use is high; of the 54% of schools using a textbook scheme, 94% (51/54) supplement their use with materials drawn from elsewhere, a figure not dissimilar to that found in Silver's (2022) U.S. study. Despite the recent textbook initiative in England, 46% of schools choose not to use any textbook as a main resource. Instead, teachers in these schools curate their own mathematics curriculum resources, drawing materials from a range of sources, including occasional use of schemes, but also drawing on online resource banks and materials of their own creation.

Despite Remillard et al. (2024, p. 64) finding that teachers make "selective and purposeful use" of curriculum resource components, the sourcing of mathematics curriculum resources has, nevertheless, triggered concern internationally. With teachers frequently using online resource banks (Silver, 2022), the quality of materials from these sources is a legitimate consideration. Polikoff & Dean (2019) examined 300 of the most downloaded materials on three sites popular with US elementary teachers, rating the majority (64%) as either "should not be used" or "mediocre, probably not

worth using" (p. 39). In England, with Marks et al. (2023) finding that primary teachers had access to at least 107 mathematics curriculum resources, similar concerns may be valid. Beyond the quality of individual resources, Foster et al. also (2021) note that "a collection of great tasks does not necessarily make a great collection of tasks" (p. 624); despite individual merits the design principles of different tasks will vary and may lead to poor coherence of the curriculum overall. Teachers' time spent on curating a curriculum is an additional concern and the plethora of resources available potentially overloads teachers; Foster et al. (2021) suggest that this time may be better spent analysing and improving existing resources to better match pupil needs.

These concerns, in conjunction with the historic and current picture of the range of approaches to resourcing the primary mathematics curriculum in England, led us to formulate the following research question for this paper:

> When primary (age 5-11) schools have autonomy to choose their mathematics curriculum resource(s), what factors underpin their resource selection?

THEORETICAL FRAMEWORK

Our research draws on Remillard's (2012) model of teacher-curriculum interactions and relationships. In this model the features of the curriculum resource used, including its pedagogical emphasis, embedded support for the teacher, and its structuring of topics and tasks, forms one key influencing factor. The second key influence is the teacher's own personal resources, for example their sense of agency, the extent to which they are viewed as a professional, their own capacity for pedagogic design and their social capital. Both are underpinned by the teacher's perception of the demands of their particular institutional context. Together these factors combine to produce instructional outcomes in the classroom. Of necessity, we have adapted this framework to render it appropriate to focus on the initial decision-making regarding which curriculum resource to use which is the focus of this paper.

METHODOLOGY AND METHODS

To understand the reasons underpinning primary schools' selection of mathematics curriculum resources, twelve 40-minute, semi-structured interviews were conducted with primary MSLs during 2022. Interview questions were developed to elicit the reasons underpinning schools' curriculum resource decision-making. Following ethical approval, MSLs were selected from English primary schools to reflect a range of situations with regards to their curriculum resources (Table 2).

Interviews were audio recorded and transcribed. Data were coded in Nvivo, drawing on coding developed by Marks et al. (2023) with additional inductively developed codes. Codes were arranged into thematic categories drawing on Remillard's (2012) conceptual model for teacher curriculum interactions, adapted for school-level decision-making. This resulted in three overarching themes. Theme 1, institutional context, focused on the school context at the point of decision-making e.g. inspection outcomes, attainment. Theme 2, key criteria for choosing a resource, focused on the

embedded teacher support, pedagogic emphasis and perceived quality of the curriculum resource. Theme 3, key criteria for staff, comprised two key areas, teacher autonomy and teacher workload.

School Group	Schools' Resourcing approach	Number of Schools
A	Uses one scheme exclusively	2
B	Uses one or more schemes with hybridity	7
C	Does not use a scheme	3

Table 2: Profiles of schools' mathematics curriculum resourcing

FINDINGS AND DISCUSSION

We present findings and discussion in relation to the three themes identified above, beginning with the institutional context (Remillard, 2012), the starting point common to all schools' decision-making.

Institutional context

Eight MSLs from schools in categories A and B described an institutional context in which evaluations of pupil progress and attainment, arising from external inspections or school-based analysis, revealed subject knowledge weakness in staff or insecure teaching and/or learning:

> One of the main targets [from inspection] was to improve maths. [MSL, School Group B]

> I think [teacher] subject knowledge was a big thing [MSL, School Group B]

For three MSLs, all in schools in group C, a key factor in their current context was the presence of non-standard and unusually diverse attainment profiles arising from having mixed-age classes and/or identifying gaps in pupils' mathematical understanding, which they perceived to arise in part from prior use of a scheme. For example:

> We saw that there were huge gaps; we were finding that children, although they may have had an understanding, it wasn't a deep understanding of maths. [MSL, School Group C]

Here differences emerge between schools in different categories in terms of the aspects of the institutional context that underpinned their resourcing decisions.

Key criteria for choosing a resource

Several features emerged as important for MSLs in terms of what their mathematics instructional materials needed to provide. Here again, differences emerged between schools in different groups. The majority of MSLs (8), all from school groups A and B, identified a need for greater consistency; this resulted in them buying a scheme. For some, the consistency required related to aspects of pedagogy, for example in the use of mathematical representations, explanations, vocabulary:

> Bringing in a scheme has enabled me to gain that consistency of representation through the entire school. [MSL, School Group A]

For others, the identified need for consistency related to the support of a consistent structure for teachers in building subject knowledge and planning for progression:

> You could look back and see exactly how things have been taught so you know how to build on it. [MSL, School Group B]

For schools choosing a scheme, some key features relating to the quality of the scheme, as perceived by the MSL, were instrumental. For some the quality of application of variation theory evident in the children's independent tasks was noted:

> You can see if you're looking for it, really careful variation in the way that they've done the questions. [MSL, School Group B]

For some schools, professional development (PD) embedded within the scheme through its lesson structure and accompanying teacher guides was an important factor in curriculum resource selection because of its value in supporting generalist primary teachers' subject and pedagogic knowledge:

> We know that the better subject knowledge the teacher has, the better the learning experience for the children. [MSL, School Group A]

Another MSL, in Group A, derived confidence in the materials from their evident research informed design, the high quality of published materials constituted a clear rationale not to create their own curriculum resources:

> You knew it was grounded in years and years of educational research that you just couldn't argue with. It gives you a really good base and vehicle for teaching mastery. This is why we don't try and write things ourselves because actually everything's deliberate.

This view of the quality of current textbook schemes presents the antithesis of the "restricted and impoverished diet" of those previously available (Haggarty & Pepin 2002, p. 584).

Research was also valued by Group C MSLs that opted to curate their own curriculum; research articles accompanying materials supported teachers to understand the activity value and intention and were instrumental in curating their own curriculum:

> It comes with quite an easy bite size article which is steeped in research, you can give people a short burst to read that is helping them to understand what the point of certain elements are and what activities there are. [MSL, School Group C]

Such articles and resource analysis supported teachers in this school to better match resources to pupil needs (Foster et al., 2021).

For schools who chose not to use a published scheme, PD was also central to their approach in two ways. First, if they had previously invested in mathematics PD, they recognized that staff had the expertise to construct and collate their own curriculum resources. Second, PD remained an ongoing priority for continued success in collating

their curriculum resources. There were examples in these schools of carefully curated approaches to PD.

Key criteria for staff

Two criteria relating to teachers' needs emerged as central to schools' resourcing decisions. For some MSLs this related to affordances for workload reduction through the use of a scheme. For others, maintenance of teacher autonomy and professionalism, arising from either not using a scheme, or using one with hybridity, was key.

For some MSLs, all of which were in Group A or B, the use of a scheme was seen as having a positive impact on teacher workload in terms of the time spent preparing lessons and sourcing or creating activities. Importantly, this was seen as a means to enable teachers to spend more time focused on tailoring teaching sequences:

> We were looking for teacher wellbeing and workload as well. Because we wanted our teachers to be spending time thinking about the lesson, the delivery of the lesson as opposed to scrabbling around, looking for [resources]. [MSL, School Group A]

For other MSLs, in both Group B and C, the maintenance of teacher autonomy was a central factor to enable teachers to make apposite resourcing decisions to meet their pupils' needs. Whilst curriculum resource quality remained important, this quality arose from teachers' professionalism to curate and interpret curriculum resources, rather than from a reliance on individual resource quality (Foster et al., 2021).

For some MSLs in group B, teacher autonomy took the form of freedom to either use the scheme or not, or freedom to adjust the length of time on a unit, or to inject hybridity through the use of other teaching materials. Thus, a key aspect of teacher autonomy was found in the freedom to exercise professional judgment in the form of decisions to adjust scheme materials to suit the needs of pupils (Gear, 2022):

> I think it's really good for teachers to have the flexibility to do their own thing. We've got loads of really very good teachers...But it doesn't mean we need to stick [to the scheme]. It doesn't mean it's always the best for those children. [MSL, School Group B]

Phrases such as 'making it your own' were used to describe the decision-making process needed to adjust a scheme appropriately for pupils' needs; however, one MSL indicated the complexity underpinning this so as not to lose the consistency and quality provided by the scheme (Foster et al., 2021).

For Group C schools, preserving teacher autonomy and the exercising of professional judgement was paramount in the decision to curate their own curriculum:

> A lot of the teachers were confident in themselves, were teaching maths to [a] deeper level, making sure all children have that really deep understanding, conceptually understanding maths. So [moving away from the published scheme] helped teachers fine-tune their teaching. [MSL, School Group C]

This decision also removed the perceived risk of teachers being deskilled (Boyd & Ash, 2018) or engaging less thinking in lesson planning through the use of a scheme.

MSLs in these schools viewed their colleagues as having high levels of subject confidence that would be further enhanced through the decision not to adopt a scheme.

CONCLUSION

In the context of primary schools in England, in which schools, and sometimes individual teachers, have autonomy to select which curriculum resources to use, schools' institutional contexts were the starting point in making decisions about the adoption of mathematics curriculum resources. Two distinct hierarchies of influence in decision-making (Figure 1), arose from the schools' institutional context.

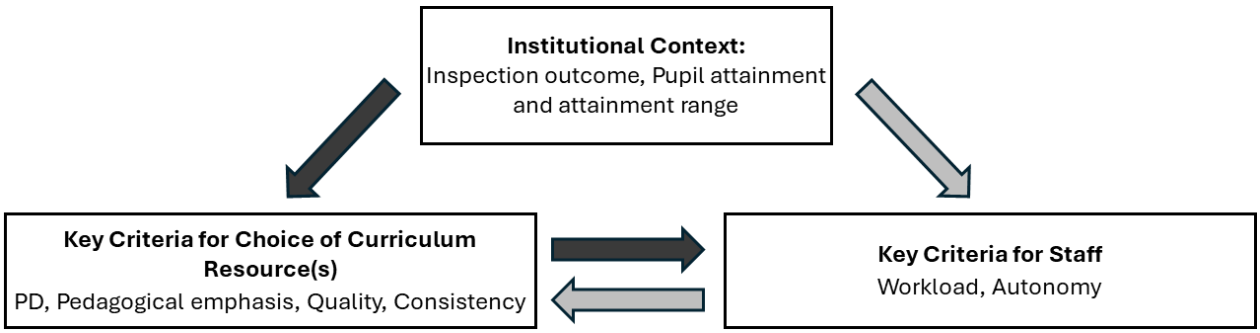

Figure 1: Hierarchies of influence in schools' decision-making about mathematics curriculum resources

Where schools articulated an institutional context in which they were responding to external or internal judgments based on pupil progress and attainment measures, the strongest influence was typically the drive to improve consistency. This led to decisions to align curriculum resource choices with a recent government initiative (DfE, 2016) and to adopt the use of mastery-style textbook schemes. The perceived high quality of these schemes and associated professional development, in conjunction with anticipated reduced workload, were cited as beneficial attributes. This met the need for consistency; some schools also valued maintaining teacher autonomy through the freedom to inject hybridity into scheme use.

A second hierarchy of influence in decision-making manifested in schools whose institutional context was characterised by a diverse range of attainment and/or gaps in pupils' mathematical understanding. The strongest influences here were school and teacher autonomy, with recognition of teacher professionalism. Whilst curriculum resource quality remained important, the overall curriculum quality was also seen to arise from the professionalism of staff to curate and interpret curriculum resources.

Notably, there was a high level of focus on the effectiveness and limitations of curriculum resources and, implicit within this, teacher confidence in resource evaluation. Whilst this does not address Foster et al.'s (2021) concern about teachers' skills in curriculum and resource design, it does demonstrate a high level of teacher reflection in the selection of curriculum resources to meet the needs of pupils, staff and schools; this may mitigate concerns about resource quality (e.g. Polikoff & Dean, 2019).

Finally, there is synergy between Remillard's (2012) conceptual model for teacher-curriculum interaction and the hierarchies of schools' mathematics curriculum resource decision-making (Figure 1) - both have the institutional context as an underpinning factor, but our findings indicate this to be central to subsequent decision-making.

REFERENCES

Boyd, P., & Ash, A. (2018). Mastery mathematics: Changing teacher beliefs around in-class grouping and mindset. *Teaching and Teacher Education*, *75*, 214-223.

Department for Education [DfE]. (2016). *South Asian method of teaching maths to be rolled out in schools*. https://www.gov.uk/government/news/south-asian-method-of-teaching-maths-to-be-rolled-out-in-schools#:~:text=The%20south%20Asian%20'mastery'%20approach,(Tuesday%2012%20July%202016)

Foster, C., Francome, T., Hewitt, D., & Shore, C. (2021). Principles for the design of a fully-resourced, coherent, research-informed school mathematics curriculum. J*ournal of Curriculum Studies*, *53*(5), 621-641.

Gear, R. (2022). Teaching for mastery and textbook tensions. *Mathematics Teaching, 280,* 25-26.

Haggarty, L., & Pepin, B. (2002). An investigation of mathematics textbooks and their use in English, French and German Classrooms: who gets an opportunity to learn what? *British Educational Research Journal, 28*(4), 567-90.

Marks, R., Barclay, N., & Barnes, A. (2023). *The prevalence and use of textbooks and curriculum resources in primary mathematics*. Nuffield Foundation. https://www.nuffieldfoundation.org/wp-content/uploads/2021/01/Final-Report-The-Prevalence-and-Use-of-Textbooks-and-Curriculum-Resources.pdf

Mullis, I., Martin, M. O., & Foy, P. (2008). *TIMSS 2007 International Mathematics Report: Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades*. TIMSS & PIRLS International Study Center. https://timssandpirls.bc.edu/TIMSS2007/mathreport.html

Polikoff, M., & Dean, J. (2019). *The Supplemental-Curriculum Bazaar: Is What's Online Any Good?* Thomas B. Fordham Institute.

Remillard, J. T. (2012). Part II commentary: Considering what we know about the relationship between teachers and curriculum materials. In J.T. Remillard, B.A. Herbel-Eismann, & G.M. Lloyd (Eds.), *Mathematics teachers at work: Connecting Curriculum materials and classroom instruction* (pp. 85-92). Routledge.

Remillard, J. T., Condona, L., Koljonenb, T., Krzywackic, H., & Sayuja, R. (2024). Teacher agency and the use of curriculum materials across cultural contexts. In T. Evans, et al. (Eds.), *Proc. 47th Conf. of the Int. Group for the Psychology of Mathematics Education* (Vol. 4, pp. 57-64). PME.

Silver, D. (2022). A theoretical framework for studying teachers' curriculum supplementation. *Review of Educational Research*, *92*(3), 455-489.