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Early grade mathematics in South Africa between 2000 and 2010: What did we know in 2010, and how did this set the stage for the 2010–2020 decade?

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Abstract

In this chapter we present a reflection on research and policy in early grade mathematics (EGM) in the 2000–2010 decade in order to consider the ground at the end of that decade, and how it laid foundations for the much broader raft of EGM-focused research studies, development policies, and projects that emerged between 2010 and 2020. Using Ball's writing on the 'essential circuits' of education (curriculum, pedagogy, assessment, and the 'hidden curriculum'), interlinked shifts were observed in all the circuits. In curriculum, there was a change from low to high levels of specification, amidst calls to reconsider specification in the face of gaps in teachers' content knowledge and ongoing low attainment by learners. In pedagogy, attention to constructivist learner-centred approaches gave way, amidst evidence of gaps in awareness of progression and evaluation, to direct-instruction approaches linked to tighter specification in the curriculum. In assessment, there was evidence of rudimentary unit-counting approaches through the decade, and later, the introduction of national standardised tests. Increased data on how learners of EGM work came into view with these assessments. These changes reflected shifts in the hidden curriculum: the post-apartheid emphasis on using education to engender critical democracy reverted to traditional disciplinary goals in the face of ongoing demands for access to knowledge.

KEYWORDS
early grade mathematics, policy, curriculum, pedagogy, assessment, South Africa

1 Introduction and background

In this chapter, we offer a reflective analysis of what we knew about early grade mathematics (EGM) in South Africa in the decade that preceded the 2010–2020 decade that is the focus of this volume. Our focus is particularly on what we knew in 2010, and how this set the stage for the initiatives in research and policy that were implemented during the 2010–2020 decade. In looking across decades in this way, we observe shifts in the focus of attention in policy, while also highlighting the ways in which research findings in the 2000–2010 decade fed into policy interventions in the decade that followed. Two findings stand out in this analysis. Firstly, there has been substantial growth in attention paid to research and policy relating to EGM between 2010 and 2020; this finding makes it clear as to why a book on EGM in South Africa over this decade is useful and important, and it has motivated us to work on this volume. Secondly, there is evidence of strong links between research and policy, with research findings in the earlier decade traceable into policy in the subsequent decade. There is also evidence of this link continuing into the 2010–2020 decade. The lineage is not always tidy, and it can be argued that it is selective, but given that some international critiques of education research claim that it simply has no impact on policy and/or practice (Kane 2016), it is important to point out that the South African story in EGM provides many instances of constructive relations between the research and policy communities.

We use Stephen Ball's (1994) writing on the 'essential circuits' of education: curriculum, pedagogy, assessment, and what he terms the 'hidden curriculum' (organisational aspects of schooling) to frame our discussion of EGM research and policy to consider the state of play in the 2000–2010 decade and how – in spite of a rather limited base of studies focused directly on EGM – it laid the ground for the much broader raft of EGM-focused research studies and/or development policies and projects that emerged in the 2010–2020 decade. Ball argues that these circuits are often interconnected in schooling, with changes in one circuit often necessitating changes in one or more of the other circuits. He also argues that it is through these circuits that changes in education systems are effected. We deal with policy and research in relation to each of these circuits across the two decades, as this allows us to point to some of the trajectories of the connections between the policy and research communities.

2 What did we know about early grade mathematics in 2010?

2.1 Curriculum: 2000–2010

The 2000–2010 decade witnessed the first wave of 'disappointments' with the hopes for post-apartheid education policy. Curriculum 2005 (C2005), with its emphases on active learning, teachers in facilitator rather than direct teaching roles, and integrated and critical citizenship-oriented learning outcomes, was introduced with fanfare

and enthusiasm in 1997. However, well before the plan for the phased introduction of C2005 through the General Education and Training (GET) Grades 1–9 was complete, several concerns were raised about its implementation. Firstly, the complexity of the language associated with the C2005 architecture (e.g. critical outcomes, assessment criteria, specific outcomes, range statements) was criticised for being inaccessible (Jansen 1999). Secondly, the sparse curriculum specification that was provided through the few 'specific outcomes' per learning area (for mathematics there were nine) to be achieved at the end of a phase was problematic for teachers with gaps in their conceptual knowledge (Taylor & Vinjevold 1999; Taylor 2000). Teachers were accustomed to more specific curriculum guidance in terms of the content to be covered within a particular grade, and were not ready to conceptualise the content for a year without such guidance. Thirdly, the curriculum foregrounded integration strongly, in particular calling for theme-led teaching of mathematics. This was non-negotiable, but teachers who had never planned their teaching in this way were left to do this without support. This was on the premise that it gave agency to teachers who, until then, had too forcefully been told what to do. The effect on the ground was that teachers felt abandoned and powerless to teach as they had always done, since their knowledge and skills were essentially not adequate for the challenges presented by C2005 (Taylor & Vinjevold 2000). This, coupled with teachers' poor knowledge of mathematical and pedagogic content, served to hollow out attention to mathematics and mathematical progression in classrooms (Taylor 1999, 2000).

Mathematics-specific and more general critiques of C2005 (Jansen 1999; Jansen & Christie 1999) led to decisions early in the decade on the need for a second wave of curriculum reform. This was put into action by the Department of Education (DoE) after the publication of the curriculum review report (Chisholm et al. 2000). This report called for the reworking of the curriculum, to align it better to the needs of teachers and the system since, the authors argued: "teachers' understanding tends to be shallow and their capacity to implement C2005 is undermined by inadequate resources, poor training and policy overload". The revision of the curriculum involved what Graven (2002) described as a "pendulum swing" back to a more traditional grade-level specification of content to be covered in the Revised National Curriculum Statement (RNCS) for mathematics for the GET Grades 1–9 (DoE 2002), implemented in 2004.

The cycles and geographies of interplay between research and policy here are of interest in the first half of this decade. Commentaries at the time that C2005 was introduced indicated that international research had strongly influenced the decision to implement it (Jansen 1999; Jansen & Christie 1999). In the wake of implementation, strong local voices – and in particular, those of the researchers cited in this section – emerged in policy-oriented and generic critiques of C2005. These voices, in turn, influenced the direction of curriculum reform in the 2000–2010 decade towards more traditional specification formats that included mathematics curricula. Mathematics education research in South Africa lay with a small number of active researchers at the turn of the century, but under their guidance, active groups were starting to form across a number of institutions. Curriculum research emanating from this emerging group arose largely in response to the new mathematics curriculum policy formulations of that decade, and focused predominantly on later grades rather than the early grades (e.g. see Parker 2006). There was limited attention to EGM within this body of work, and the mathematics curriculum analyses, like the generic curricular analyses that

had preceded them, tended to look at curriculum forms across phases rather than at the content within particular phases.

Late in the decade, in the midst of further disappointments with the ongoing evidence of low attainment, there were the beginnings of concerted attention to curriculum in EGM and at primary level more generally. This attention was particularly visible in the curriculum documentation linked to the Foundations for Learning (FFL) curriculum campaign (DoE 2008). This was a four-year campaign that introduced a curriculum guide that sharply increased the degree of specification, and particularly so in relation to sequencing and pacing, with termly 'milestones' stipulated and details on what to cover on a week-by-week basis. The milestones were argued as necessary to "ensure that there is conceptual progression both within a term and throughout the year" (10).

In addition, increasing attention was paid to including key manipulatives, resources and representations in the FFL policy (DoE 2010). For example, flard cards (place value cards) and number charts were explicitly listed for use in exemplar assessment tasks, with these kinds of resources provided in a resource box that supported policy implementation in schools. In this respect, the FFL policy increased the explicit attention given to early number-teaching by providing resources that included 'structured' representations – representations underpinned by the decimal structure of the number system. There was thus an overt move in the policy to specify curriculum content and offer resources in order to guide pedagogy, with further detailing of linked assessments in the FFL document. There was a concerted move, then, to connect the essential circuits for broad-based change in the teaching of EGM in this policy.

While the FFL curriculum was not widely implemented on the ground, its formulation was interesting because it represented, in many ways, the polar opposite of the 'teacher as skilled and responsive facilitator' position that had been advocated a decade or so earlier. Instead, this policy represented a firm return to a focus on teachers as being responsible for curriculum delivery in a standardised one-size-fits-all model, and needing support in the form of specification to do this. Although they were not seen as such, the FFL materials pre-empted the scripted lesson plans that started to emerge in the next decade with the Gauteng Primary Language and Mathematics Strategy (GPLMS) – a provincial intervention that was launched in 2011.

This view of the kinds of support that teachers needed in curriculum specification proved to be an important leitmotif through the 2010–2020 decade when we look back at the national policy landscape of EGM, and the kinds of curricular reformulations that followed.

2.2 Pedagogy: 2000–2010

Concerns about gaps in teachers' knowledge of mathematical content have never been far from the epicentre of focus in post-apartheid South Africa. As noted already, these concerns were raised in the context of the sparse specification of C2005, but concerns continued to be voiced later in the 2000–2010 decade, in the context of the RNCS (Carnoy & Chisholm 2008) and into the next decade in the emerging analyses of teacher-test response data (Venkat & Spaull 2015) from the Southern Africa

Consortium for Monitoring Educational Quality (SACMEQ) and other projects that were based in several provinces (Taylor 2011). But these studies focused predominantly on teachers in the Intermediate Phase, and provided limited detail on the understandings and implications for maths pedagogy in the early grades. The Advanced Certificate of Education (ACE) courses that had been introduced early in the post-apartheid era as a route for upskilling teachers in the system on mathematical and pedagogic content-knowledge were facing extensive criticism by the middle of the 2000–2010 decade, with a damning report from the Council on Higher Education (CHE 2010, 120) describing ACE programmes in mathematics as "uneven and variable" in quality.

Pointing to teachers' knowledge in EGM classes, and based on classroom observations and an evaluation of learners' work, Hoadley's (2007) detailed comparisons of pedagogy in working-class and middle-class schools in the Western Cape suggested that evaluation of children's responses was not just limited, but sometimes entirely absent. In the worst cases, young children were left unaware of whether their work was correct or incorrect.

The richer understandings of pedagogy in EGM during the 2000–2010 decade tended to come from sociologically-oriented studies, with Bernsteinian lenses proving particularly salient. Slow pacing had been pointed out as a feature in early observational studies in the C2005 years (Jansen 1999). The specifics of pacing were elaborated on in the work of Reeves and Muller (2005): their study focused on the coverage of mathematics in the Intermediate Phase, and it reflected the earlier finding of slow pacing, but also highlighted a poor understanding of mathematical progression among teachers. Towards the end of the decade, Ensor et al.'s (2009) study showed that poor understandings of progression were evident in EGM too: their small-scale study indicated ongoing provision of concrete unit-counting manipulatives such as cubes or counters across all the Foundation Phase (FP) grades, and advocacy to use them, but with limited pressure for learners to acquire familiarity and competence with number as a symbolic and structured system.

Alongside the sociologically-oriented studies, there was a smaller vein of research in the mathematics education field in South Africa. The approach used in the Dutch Realistic Mathematics Education (RME) studies had been appreciated by many South African researchers when C2005 was introduced, since they aligned well with the constructivist approach to teaching that underpinned the various iterations of the curricula developed in the early curriculum review processes. The importance of building deep, long-term mathematical understanding by starting from contexts that learners can make sense of is fundamental to RME. Many small-scale studies of learning (mainly focused on the Intermediate Phase, since EGM was not a target of much academic research at the time) investigated best practice for the teaching and learning of mathematics within the RME paradigm, investigating the value of sense-making lenses and problem-solving as the route to making meaning. A trio from Stellenbosch University were the primary drivers of this research: Hanlie Murray, Piet Human, and Alwyn Olivier. They published findings on the possibilities within such pedagogies, many written with United States-based collaborators with interests in approaches that were oriented to problem-solving (e.g. Hiebert et al. 1996; le Roux et al. 2004); they also produced many curriculum-support guides and open-source material for teachers – the Malati materials among these. Murray was the team's expert on the South African Foundation Phase; she also worked with a broader international EGM

team, all of whom were interested in researching and writing about the learning and teaching of mathematics. Their publications drew on constructivist approaches of working with child-developed methods and sense-making in the work of non-routine problem-solving, and they influenced curriculum development in mathematics within C2005 with papers and curriculum materials that focused on EGM teaching (e.g. Carpenter et al. 1999) and teacher-development (Murray et al. 1999). In terms of mathematical content, different number and operation concepts were a focus of this work (e.g. Hiebert et al. 1996; Fuson et al. 1997; Carpenter et al. 1999).

In contrast to the child-centred thrust of the Stellenbosch group, some pockets of research were starting to raise the issues of poor knowledge of mathematics content and of pedagogic content, and poor knowledge of teaching for progression, in ways that pointed towards the need for more direct instruction. In 2004, one such project that proposed a 'back to basics' approach to address poor learning in schools was established by Eric Schollar in Limpopo. The Primary Mathematics Research Project (PMRP), which used a specially stratified workbook for the Intermediate Phase (designed to help close gaps in learning), pointed to the disparity in learners' levels of competence in Grade 4 to 6 classes (Schollar 2015). In order to determine the level at which learners accessed the book (it allowed for four levels of parallel workstreams in one book), learners were tested and found to be up to three years behind (in Grades 4, 5, and 6). While we deal with Schollar's assessment outcomes in more detail in the next section, this study was important because its preliminary findings (Schollar 2008) exposed graphically that unit-counting, introduced through the use of manipulatives in the early grades, with a move to drawings of these counts (using tally marks or small circles), had become the 'go to' method for calculations in higher grades (Schollar 2008). While others (e.g. Ensor et al. 2009) subsequently expanded on some of the ways in which pedagogy was feeding into the issue of unit-counting, the work of Schollar was important for its graphic illustrations and its scale. The PMRP was carried out in two phases, encompassing 7,028 learners in Phase I and 4,256 in Phase II (Schollar 2008, 4). It made the prevalence of one-by-one counting on the ground clear in a way that allowed and encouraged the beginnings of a national policy response that suggested moving away from counting based on tally marks in calculations. Publications such as the Annual National Assessment (ANA) Diagnostic Report (DBE 2013) were part of this.

Schollar's study stood out from the other mathematically-oriented studies at the time, which leaned towards investigating the development of critical thinking and ways to encourage meaning-making by learners and teachers (rather than going back to basics). It also stood out in relation to the small-scale qualitative sociological studies on account of its much larger survey-based scale involving 194 schools across its two phases.

Across the pedagogy-based studies, the differing slants in their relation to problems on the ground are interesting. The small-scale studies of pedagogy coming from a sociology base and that focused on EGM often included purposive, stratified sampling that lent weight to concerns about teachers' content knowledge – playing out in terms of pedagogic content knowledge as well as poor understandings of pacing and progression. Further, while the sociologically-based studies sought to *analyse* the ground, the maths education work of the time sought *development* on the ground. The latter community worked for development in different ways, with the Stellenbosch community offering 'pictures of the possible' when highly knowledgeable and skilled

teachers and teacher-educators worked directly with learners or teachers. The caveat was the scale of this work – as the model was difficult to scale up in the grandeur of its ambition to shift cultures related to mathematical working and mathematics teaching on the ground, even if the materials linked to their vision were available. In contrast, Schollar worked for development via a far more direct approach, arguing strongly for a focus on the basics of place-value and arithmetical operations in the midst of the need for change at a much larger scale.

Taken together, these findings – during the second half of the 2000–2010 decade – supported the moves towards greater specification of the mathematical content, sequencing, and pacing aspects in curriculum that we referred to in the previous section.

2.3 Assessment: 2000–2010

The focus on assessment mirrors the focus in research in the decade 2000–2010, with not much reporting on EGM assessment, even from the Education Department. Curriculum documents were always provided (for all grades) but reporting on student achievement or functionality of curriculum implementation was almost non-existent for early grades, with the interest and focus being on Grade 12 (matric) and the school-leaving examination. Poor achievement in matric received much attention, and interventions to address it were aimed at the Grade 12 or Grade 11–12 years. The first indicator of student performance below matric came in the DoE's Systemic Assessment Report (2003). Schollar (2015) noted that this report pointed out that

> *the majority of South African school students [lag] far behind the expectations of our own curriculum, and that of their international counterparts, including those in Africa (18).*

The report stimulated interest in activity in schools, and the department produced the first assessment policy for all grades (DoE 2005). This was a guiding document for assessment in Grades R–12, the purpose being to standardise recording and reporting. It left design of tasks in the hands of schools, and emphasised the importance of having a range of assessment activities; this was relevant since the curriculum, starting with C2005, recommended a variety of assessment tasks (projects, presentations, group activities, etc., in addition to tests). The poor performance also lent support to the arguments made for curriculum change mentioned earlier.

During this period, South Africa began to take part in international testing such as that of the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA), but only for higher grades. Grade 6 was the grade closest to EGM in all of these studies at the time. South Africa took part in the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) II tests in 2000 and in SACMEQ III in 2007. The results showed that while the performance of South African learners improved slightly across the two SACMEQ studies (by 9 points in mathematics), they were still underperforming in mathematics compared to the SACMEQ average (Moloi & Chetty 2011).

Growing concerns were raised through the decade about the disparities seen in reported outcomes between internal school-based assessments and external

standardised assessments (Van der Berg & Louw 2006). These pointed to poor understanding of the variety, forms, and purposes of assessment suggested in the policy, and contributed to growing calls for national standardised assessments. This led to the proposal to introduce ANAs in the FFL campaign. The first set of ANAs were conducted at the end of 2008 and targeted Grades 1–6. Chetty (2016, 9) notes that while the impetus for introducing ANAs was to improve learners' performance, the assessment model also introduced a mechanism for making teachers and schools accountable; this – in the next decade and in the context of teachers' unhappiness and pressure from unions – led to the demise of these assessments.

In terms of student achievement data for EGM, the ANA outcomes suggested higher mean performance in the FP grades than in the Intermediate Phase (IP) and Senior Phases (SP), leading to an initial flurry of focus on Grade 8 and 9 interventions. However, the suggestion of all being well in the FP was contradicted by the ongoing evidence of unit-counting seen towards the end of the decade (Ensor et al. 2009).

2.4 Hidden curriculum: 2000–2010

We began our work on this chapter by noting that the 2000–2010 decade saw the first wave of disappointments after the hopes and ambitions that had come with C2005. Many of these hopes, understandable in the transition to democracy, were linked to critical political visions of emancipation, of leaving behind the authoritarianism of apartheid that had infused schooling and all other aspects of society. This was thus a transition decade in terms of the views of what education generally, and mathematics education specifically, could achieve. Rather than seeing education as a key arena of hope for changing society, the political view, by 2010, was very much on how government and NGOs could contribute to 'fixing' schooling, with learners' performance and classroom pedagogy in EGM coming increasingly to the fore, to attention to policy, by the close of the decade.

What we see when looking across the essential circuits from an EGM perspective is the 'overlooking' of EGM as a site for policy attention in subject-specific ways in the 2000–2010 decade. We noted the very small number of studies focused on EGM in the mathematics education research field – a finding echoed in a review published towards the end of that decade (Venkat et al. 2009). But there was also a growing accumulation of data from different types of studies that, collectively, was pointing to problems with mathematics as taught and learned in primary schools, and within this – specifically – showing that all was far from well in the teaching and learning of fundamental number concepts.

3 How was the stage set for what happened in 2010–2020?

In this section the discussion elaborates on the ways in which Ball's (1994) 'essential circuits' (curriculum, pedagogy, assessment, and hidden curriculum) developed from what had been established and questioned between 2000 and 2010. Starting here

with the 'hidden curriculum', the shift in orientation from 2000–2010 to 2010–2020 was seen in the sharp reversion away from an emphasis on localised and relevant curriculum and teaching as needed for critical democracy, towards standardised delivery models of teaching. This standardisation was driven by ongoing concerns for educational access and equity. The other circuits similarly showed shifts, drawing on the research that emerged over the previous decade. We do not demarcate them in our discussion that follows as we did – for analytical purposes – above, as this allows us to point more generally here to their interconnections.

By 2009, with ongoing concerns voiced regarding curriculum, with particular emphasis on the clumsiness of having so many curriculum documents (there were separate content and assessment policy documents, for example) and the difficulties this presented for teachers, a task team was appointed to investigate the nature of the challenges experienced in implementing the RNCS. This led to the development of the Curriculum and Assessment Policy Statement (CAPS) – an 'all-in-one' statement. The implementation of CAPS started in 2012.

At this time, awareness of under-resourcing in schools was growing. The work of Schollar (2008) had drawn attention to the value of a workbook for learners. In the 2010 budget speech, the Minister of Finance announced that an extra R2.7 billion would be allocated to the development and printing of workbooks in all 11 official languages to help raise literacy and numeracy levels (Gordhan 2010, 18). In addition to the awareness in EGM that curriculum implementation was not just a chalk-and-board or paper-based activity, the issue of learning and teaching support material (LTSM) became part of the curriculum discussion. The national workbook (which has become known as the DBE Workbook) picked up on the FFL project's provision of daily material for teachers (and now learners), and packs of manipulatives were also developed and delivered to schools. The DBE Workbook was linked to the sequencing in CAPS, and it set up a highly prescriptive, standardised programme that was taken up and followed by most schools in South Africa. Their link to the ANAs was one of the key drivers that got schools using DBE Workbooks, and there was evidence of teachers "teaching to the test" (Spaull 2015). Another issue with the ANA outcomes in EGM was that results were seen as inflated due to teachers' marking for answers only, without attention to whether these were produced through inefficient unit-counting (Weitz & Venkat 2013). Referring to the more standardised CAPS curriculum model, Kanjee and Moloi (2014) argued that assessment literacy remained a problem among EGM teachers in that it focused only on summative assessment, despite curriculum imperatives continuing to stress the importance of formative, ongoing assessment.

Several chapters in this volume deal with the assessment circuit and the findings that emanated in the 2010–2020 decade from the swirl of assessments currently being used across regional and international comparative assessment projects: examples are the 2019 TIMSS study (Spaull, Courtney, & Qvist, this volume) and research-based assessments (Spaull et al., this volume). Worryingly, but predictably, Spaull et al. note the impact of Covid-19 on the school system and on how it has lowered outcomes further. Nuga Deliwe and Van der Berg (this volume) discuss both the promise and the demise of ANA in South Africa, and reflect on what may be required of national policy assessments in early grade mathematics in order to feed through formatively into improved teaching and learning.

Curriculum-led teacher development and pedagogical support from the Education Department came in through more detailed specification in the curriculum, but training on how to translate it into practice was very limited. Provinces began to develop their own teacher-support programmes, for example, the GPLMS in Gauteng and the Language and Numeracy strategy (LitNum) in the Western Cape. Generally, these programmes provided 'whole' CAPS specification, showing only limited responses to specific critiques of methodologies and to awareness of gaps in learners' knowledge at a national level. The strict policy monitoring of curriculum coverage at the time made it very difficult to move away from policy mandates. Once again though, evidence from research was influential, with studies early in the decade raising questions about coherence and connections in the teaching of number in EGM (Venkat & Naidoo 2012), amidst ongoing evidence of serious gaps in primary teachers' content knowledge (Taylor 2011; Venkat & Spaull 2015).

An important new thread in this latter work was stimulated by funding from the European Union, and it was intended to focus on the Initial Teacher Education Project (ITERP). Studies started to draw increasing attention to the role universities could play in addressing shortcomings in primary teachers' mathematical knowledge (Bowie 2015; Bowie et al. 2019). This body of work accelerated in the second half of the decade and extended into development activity.

A sharp increase in research and development on how to support teaching in EGM was also driven by the introduction of the SARCHI Numeracy Chairs' work in 2011 (based at the University of the Witwatersrand [Wits] and Rhodes University) and the parallel work of the Magic Classroom Collective project at the University of Fort Hare. The Wits Maths Connect-Primary Chair project skirted the strictures of dealing with the whole curriculum by developing a series of interventions focused on number sense, for use by teachers in the mental starter section of lessons in a longitudinal project. Their results indicated improvements over time in EGM teaching and learning, and their work expanded to provincial and national scales (Venkat, Askew & Morrison, this volume). The South African Numeracy Chair project at Rhodes University focused attention on early number-teaching and support with materials for use in after-school clubs, and showed promising results (Graven et al., this volume). Across this work, both projects have focused extensively on the curriculum (via number-related topic materials) and 'essential circuits' in pedagogy. The Magic Classroom Collective project, focused on literacy and numeracy in EGM over the decade, produced combinations of curriculum materials and teacher-development activities with a greater focus on working with home languages in teaching (Porteus, this volume). This focus on home-language instruction is a key aspect of the 'hidden curriculum' of South African schooling, with ongoing evidence of differential outcomes based on the language of instruction (Taylor & Von Fintel 2016); there is evidence, too, that research on how to support home-language instruction is limited (Essien 2018). Feza et al. (this volume) offer an overview of the research on using African languages to support early mathematical learning. The growing attention to ways of incorporating multilingualism in intervention studies and in research is reflected in a number of chapters in this volume. Addressing Essien and Sapire's critique (this volume) of the predominance of 'monoglossic' approaches that are confined to one language, rather than 'heteroglossic' approaches that allow fluid movement between languages in ways that respond to the languages of children

in classrooms, Roberts et al. (this volume) detail an approach based on story-telling to support children's sense-making in mathematics.

The writing of Spaull (2016) and Spaull and Kotze (2015) on learning outcomes in primary mathematics was influential in raising questions about the efficacy of the rigid CAPS implementation regime. This resulted in programmes that brought in more flexible methodologies and some shifts in the way in which curriculum policy was interpreted. At the same time, larger-scale programmes were also being developed in response to the dire state of mathematics learning on the ground. A national *indaba*, hosted by the Minister of Education, on the theme of 'Meaningful and effective mathematics teaching and learning: In search of the South African pedagogical identity' led to the writing of a framework (DBE 2018) to guide the teaching and learning of mathematics in the country. This was not a policy document but guidelines that aimed to unify collaborators working in the field of maths education, and strengthen the delivery of support (across all systems in the department). The Teaching Maths for Understanding (TMU) pilot study was launched in 2019, based on materials that (with the approval of the minister) followed a 'reorganised curriculum'. This was important in that it opened up the possibility for others to trial different pedagogies, some feeding into larger-scale interventions like the Bala Wande programme (Sapire et al. 2022) later in the decade. The latter paid explicit attention to number-learning while dealing with a somewhat revised, but still 'whole curriculum', model. The Bala Wande programme materials include workbooks and teacher guides, dictionaries (all bilingual in support of language in the multilingual context) and extensive inclusion of structured mathematical manipulatives.

As we have said, the 2010–2020 decade marked a change in reporting on assessment in EGM, but there were still few studies that reported on learner data at this level (see Ardington et al. Volume 3). What stands out during this decade is that school-based assessments across the system were critiqued for not matching outcomes seen on external standardised assessments (Van der Berg 2005). With the demise of the ANA, the only systemic reporting on mathematics outcomes focused on grades above EGM (SACMEQ, TIMSS, and the Progress in International Reading Literacy Study [PIRLS]). The latest TIMSS results show stagnation (even before Covid-19) in IP outcomes (Reddy et al. 2020). On a smaller scale, promising assessment outcomes have been reported in the narrower foci of interventions by Chair projects and the Magic Classroom Collective (MCC) in EGM. At least one larger-scale programme will yield rigorous outcome data on EGM (Bala Wande), but this is yet to come as the programme is in progress at the time of writing this (see Ardington & Henry 2021).

4 Conclusion

Reflection on the decade 2000–2010 shows that the early lack of attention to EGM began to change towards the end of the decade and that by 2020, through a range of mechanisms, many varied studies in EGM were under way. Most of the more recent medium-and larger-scale work is reported on in this series of books. The rich variation of studies in EGM (large- and medium-scale, and related to policy, pedagogy, and

curriculum) now provide hope that burning issues in maths education will not be ignored, and problems that have plagued the system for decades will be addressed. The wave of disappointments from analyses of 'what is' has given way to studies investigating a range of options for 'what might be', so the tide may be turning towards change that will ultimately benefit the system and hence the South African learner of EGM. At the same time, however, and as noted already, Covid-19 has created setbacks for learners entering the system and who are in EGM following two years of lockdown. No doubt, more research on the lags will be done in the next few years. Still, more is known about EGM now than was the case in 2010. Reflection on the studies of the past two decades suggests that the route to effective change is to address it from several angles: from the Department of Education, policy and LTSM should support effective teaching; from the research community, ongoing studies should continue to clarify best practice through both larger- and smaller-scale quantitative and qualitative studies; from the tertiary education sector, where quality and relevance of teacher-education should be a priority; and finally collaboration between all parties involved in the endeavour to lift the bar in EGM teaching and learners' outcomes is essential.

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