# Unlocking Minds: Exploring the Pendulum of Mathematics Pedagogy

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Current debates and the related impact of policymakers and educational leaders on teaching and learning in mathematics is a cause of concern and even anxiety amongst researchers and teachers alike. While these debates are playing out differently across the world, there are common challenges we face. In this lecture I draw on voices from previous Clements-Foyster lectures and use the lens of my own experiences as teacher, researcher, and leader of MERGA and AAMT to discuss and explore the current pedagogy debate in mathematics education. I argue against the use of a narrow evidence base that is fuelling the debate and I reflect on the current and potential future impact of research emerging from MERGA as a collective, and individual members.

It is a great privilege and honour to be invited to deliver the MERGA47 Clements-Foyster Lecture at what is arguably a tumultuous time in mathematics education in Australia, New Zealand and beyond. Given that the timely theme of this conference is *Unlocking Minds in Mathematics Education*, the current landscape will serve as a context for this lecture, where I will reflect on the impact of mathematics education research on education policy and classroom practice.

Previous Clements-Foyster lectures have provoked reflection on a range of topics including the quality of research in mathematics education, debates over dichotomies such as that which is currently occurring, and the positioning of MERGA as a key influence in mathematics education. For example, in the inaugural Clements-Foyster address in 2005, David Clarke discussed a range of dichotomies in education. It is twenty years on, and those dichotomies appear unchanged and perhaps more divided than ever. Ten years later, Tom Lowrie wrote: "it is also important that our research empowers people, and that our recommendations and implications improve systems, especially for the disadvantaged" (2015, p. 23). MERGA's mission states the association is "committed to growing a research community that shapes the future of mathematics education through quality research" (n.d.). While it appears that we may not currently be exercising significant influence on policy and subsequently practice (particularly in Australia), this does not mean we should not continue to strive to influence policymakers and system leaders moving forward. It is time to pause and perhaps recalibrate and consider whose minds we want to unlock and how we should be working collectively to do this.

In his Clements-Foyster address at MERGA 37, Peter Galbraith (2014) concluded his paper by proposing that we, as individual researchers in mathematics education, write down the things about the theory and practice of mathematics that currently outrage us before sharing those outrages with each other. He wondered what might emerge, what imperatives would be suggested, and what we could do about it. In this lecture I too aim to stimulate critical reflection and discussion regarding the current landscape of mathematics education for us as a research community, and for each individual, whether researcher or teacher. I will pose questions that may not be possible to answer yet remain worthy of consideration. I draw on my experiences as a teacher, a researcher, a past MERGA president, and the current board Chair of the Australian Association of Mathematics Teachers (AAMT) to begin with a brief discussion on the current context before considering the impact of mathematics education research and the

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potential and opportunities for increasing the impact of our research where it matters, in mathematics classrooms.

## Evidence-Based Mathematics Pedagogy

In conceptualising the current landscape, I use the analogy of a pendulum. Within this analogy, the overhead support of the pendulum represents the mandated curriculum to be delivered and enacted in mathematics classrooms. The teacher is represented by the 'pivot', which connects the pendulum string to the overhead support, allowing the pendulum to swing the 'bob' from side to side. At opposite sides of the pendulum are dichotomies such as direct instruction (DI) versus inquiry-based learning (IBL), which represent elements of the current debates in Australia, New Zealand and beyond. At this point in time, across several school systems in Australia, the pendulum appears to have oscillated to the extreme of one side, towards a DI approach, where it appears to be somewhat stuck, and to some degree, is resulting in pedagogies that are misaligned or even clashing with curriculum expectations, potentially weakening the enactment of the curriculum in our mathematics classrooms.

### Whose Evidence?

A noticeable element within the current debate is the emphasis on using evidence-based practice. In Australia, bodies such as the Australian Education Research Organisation (AERO) (Australian Education Research Organisation (AERO), 2023a, 2023b) and the Centre for Independent Studies (CIS) (Merlo, 2024) use select research as the evidence base to support their stance, with a heavy emphasis on cognitive science, applying findings in a one-size-fits-all approach across discipline areas including mathematics. This has led to a direct and significant influence on policymakers in several of our education systems, including a strong emphasis on highly structured explicit teaching in NSW (NSW Department of Education, 2024), Victorian government school systems (Department of Education and Training, 2024) and other states and systems.

There is no argument against the merits of cognitive load theory and the use of explicit teaching in mathematics education. However, this should not be highlighted at the expense of flexible and responsive teaching, student engagement, and authentic mathematical problem solving and inquiry, which appears to have been diluted in directives to teachers (e.g. Centre for Educational Studies and Evaluation, 2020). For example, teachers in the NSW Department of Education have been informed that "explicit teaching does not involve students engaging in independent learning activities and problem solving before teachers provide the necessary explanations, demonstration or modelling" (p.1), in direct contrast with findings from mathematics education research that claims these types of strategies potentially limit opportunities for higher level mathematical thinking (Ingram et al., 2020).

Moreover, what is alarming about the current situation is the lack of reference to mathematics education research and a lack of consultancy with practicing educators and academics directly involved in mathematics education, despite efforts to provide formal and constructive feedback (Mathematics Education Research Group of Australasia, 2023). This has exacerbated the issues caused by the narrow evidence base: an omission that has not gone unnoticed or unquestioned, as recorded in the Australian Government Senate Estimates (Parliament of Australia, May 2024).

Lingard (2013) states "any educational policy research of any type ought to have at the broadest level a desire to make things better in education...to improve education policy, including conceptualization and enactment" (p.116). While there is no argument the desire to improve mathematics education is present amongst educational leaders and policymakers, the narrow use of evidence currently informing policy has resulted in a range of interpretations, translations and applications across school systems that do not always promote what we in the

mathematics education research community consider to be effective, evidence-based, and responsive practice. For example, some systems have mandated the use of a specific, DI teaching program with the expectation that a one-size-fits-all approach will improve student outcomes in mathematics, with no acknowledgement of context, reducing the role of the teacher to technician rather than professional (Wiliam, 2019). Other systems are strongly encouraging prescribed lesson structures that do not allow for flexibility and responsive teaching, with no acknowledgement of teacher expertise and restricting teachers' autonomy and ability to respond to their students' needs as they arise. There is a clear gap between mathematics education research and policymaking, that have led to reforms that do not fully consider the reality of classrooms.

## Best Practice?

If we consider mathematics education through the lens of the theory of practice architectures as discussed by Peter Grootenboer at MERGA44 (2022), we acknowledge that a single practice cannot address the needs of all students due to the complexities of the site where learning occurs.

> ...the notion of "best practice" is, at best, an unhelpful myth, and at worst, a damaging misconception that sees all learners, sites, and communities as homogenous. The site-based nature of practices, including mathematics education practices, means one can only talk of "best practices *here* and *now.* (p.3)

Other evidence from mathematics education research aligns with this position (e.g. Anthony & Walshaw, 2009; Clarke, 2005) yet this evidence appears to have been ignored. Recent reports using an evidence-base sourced from cognitive science and educational psychology, espousing a "best practice" in mathematics teaching, have made false assumptions that are conveniently not supported by evidence leading to broad generalisations about pedagogy and student learning. Further, elements of the current debate have grown out of arguments that were initiated within the literacy/phonics domain (Hunter et al., 2023). For example, in the CIS report that attempts to replicate the Science of Reading within the discipline of mathematics education, *Science of Maths and How to Apply It,* Merlo claims: "Engagement happens via building competency and setting students up for success, not via relaxing requirements on correctness of answers or refraining from using timed-tests" (2024, p. 2), indicating a lack of attention to research that clearly defines engagement as more than compliance, and ignoring the multidimensional nature of engagement (e.g. Attard 2014, Fredricks etc. 2004). This is followed by the assumption that there are teachers of mathematics who do not value correct answers from students. Further, other claims in this report are equally misinformed and not supported by evidence:

> Pendulum-swings in the last 40 years have gone from almost pure emphasis on procedural knowledge and rote-learning to the detriment of understanding, to conceptual understanding without building fluency and teaching procedures. (p.18)

## False Dichotomies

The practice of using a select range of evidence to support a specific argument is not a new one, as noted in de Jong et al. (2022), who discuss the same pedagogical debate. Further, there is evidence that this dichotomy is a false one, and evidence exists to support the use of DI, IBL, and other pedagogies in a complementary manner. In his Clements-Foyster lecture, Clarke (2005) argued that dichotomies constructed as oppositional "offers a set of false choices, sanctifying one alternative, while demonising the other" (p.13). Clarke used the term 'essential complementarities' to describe how such oppositional ideas should be considered complementary. He provided the example of the dichotomy of socio-cultural and constructivist theories. He posited that while both theories can be constructed as competing, "Any conception of either theory that precludes the other is arguably inadequate" (2005, p.2). This can be applied

to the current debate and in support of this position, de Jong et al., (2023) provide an evidence-base to support the claim that IBL and DI can be complementary, stating:

> Regardless of whether direct instruction or inquiry is the core of the lesson, lesson series or curriculum, additional instructional strategies and activities are usually needed to make the approach work. Different instructional strategies can coexist in a lesson. (p.8)

From the perspective of a teacher and researcher in mathematics, it is common sense that there is no one way to teach mathematics. No single practice should be employed at the expense others, and at the expense of student attainment and engagement. As stated by Siemon (2019):

> ...when one approach/practice is privileged over the other on the basis of research it invariably leads to a form of tribalism that pits individual against individual and group against group in a way that is unproductive" (p. 50).

The pedagogy pendulum should oscillate in response to student needs. Context matters, and as Grootenboer (2022) states:

> ... *mega conditions* (e.g., national or state curricula, external assessment regimes, policies) that are overly restrictive and controlling, because they limit the capacity for mathematics education that is responsive to the unique site-based needs and requirements and conditions. For example, if mathematics teachers are to practice in a reflective and responsive educational manner, then they require scope to develop and enact their pedagogy within the guidance of curricula, and not be slavishly required to follow a detailed prescription of teaching activity. (p.5)

While there may be several reasons for the reliance on a skewed evidence base informing policy, for example, a lack of large-scale quantitative studies, this is not a new phenomenon. Berliner (2002) commented on this issue, rejecting the reliance on "scientific" research and stating that such a reliance results in a misunderstanding of educational research. Berliner posits that educational research is a 'hard-to-do' science due to "the power of context, the ubiquity of interactions, and the problem of "decade by findings" interactions" (p.18). Arguably it is the ubiquity of interactions alongside unique contexts, including differences in personnel, programs, teaching methods, budgets, community support and socio-economic status, that are absent from the narrow evidence base currently being presented to leaders and teachers in schools. In addition, Berliner's concept of "decade by findings" is extremely relevant to the current landscape and the use of research findings that no longer align with the context of education in 2025. A significant amount of the evidence behind much of the current push towards prescriptive teaching approaches is drawn from research that is more that 20 years old, making it obsolete because of shifts in social, cultural, and intellectual environments.

> We should never lose sight of the fact that children and teachers in classrooms are conscious, sentient and purposive human beings, so no scientific explanation of human behaviour could ever be complete. (Berliner, 2002, p.20)

## Looking Forward

The current landscape has, to some extent, resulted in uncertainty for practitioners (policy makers and teachers) and researchers. Rather than lament the current situation, we must be proactive rather than reactive in our response. With this as a motivation, the AAMT recently published a position paper (2025) that draws on a broad and balanced range of research evidence to provide a clear repertoire of strategies that includes a range of practices. The paper is supported by a dynamic reading list (including evidence from both sides of the debate) to encourage informed and critical discussion. In theory this paper, alongside MERGA's position statement on pedagogy (2025), should begin to release the pedagogy pendulum and allow teachers to control its swings according to student needs. However, there is no guarantee that broader mathematics education research will become a part of the evidence base used to inform policy and practice unless we reflect on what we are doing, and how we are doing it now, and ways we can be doing it differently to increase our impact on policy, school leadership and in classrooms, opening minds where it matters most.

The current debates are not new and should continue to be argued. In an era where educational policy often contradicts findings from mathematics education research, it is crucial for us, as a research community, to critically assess our impact. As Lowrie (2015) stated, we may have become too comfortable, and this sense of comfort has resulted in policy makers turning away from MERGA research in their bid to cause change.

## Reflecting on Impact

The current landscape leads me to question why our (MERGA'S) research may not be having the intended impact. Why is our work not resulting in a pendulum that oscillates gently according to student needs and contextual circumstances? In her Clements-Foyster lecture at MERGA46 Janette Bobis (2024) discussed the importance of understanding the concept of research significance, or the 'so what' factor. Bobis presented a list of synonyms for significance, and this included the terms implications, benefits and impact. While research may be significant in generating new knowledge, it does not always translate into real-world impact beyond academia or influence educational policy post publication. Bobis also considered Hiebert et al.'s Chain of Coherence (2023) that runs through a research study and perhaps we should be considering how this model could be extended to plan for, improve and assure ongoing impact.

Further, it may be that we need to unlock our own minds and consider how we define impact and what we, as educational researchers, value as impact. While research institutions highly value citations in academic literature and journal impact scores, educational research also prioritises its influence on policy and classroom practice. However, achieving this impact is more challenging, and measuring it remains difficult. Lingard acknowledges that "the impact of research on practitioners works in multifarious, mediated, and non-linear ways" (2013, p.115). However, academics receive little institutional recognition for publishing in professional journals or producing outputs that directly reach practitioners in classrooms. As a result, there is little individual incentive to promote research outcomes beyond academia. However, there is a collective incentive to improve mathematics, and this is where MERGA's role is critical.

Over a decade ago Lingard (2013) questioned whether there is a "pressing need to reconsider the actual and desired nature of research-policy relationships in education" (p.113). Arguably, the need is more pressing now than ever before. Lingard provides a distinction between research relating explicitly to policy matters and the larger body of research that has the purpose of contributing to knowledge more generally, which perhaps describes much of the research emerging from MERGA members. The most recent RIMEA publication (Mesiti et al., 2024) includes a depth and breadth of research that not only refutes much of the evidence-base currently informing policy but has clear implications for practice. However, while we may view such findings as important, they may not explicitly address the perceived needs of those developing policies to addresses system-wide problems. Furthermore, we must consider whether readers of RIMEA are those we should be trying to influence. What more could we do with this important synthesis of research?

## Increasing our Impact and Influence

Reflecting on the present landscape and adopting a proactive mindset, we need to consider how MERGA, both as a collective and as individual researchers, can progress to realign our approaches, and to unlock minds. Apart from increasing the visibility and reach of MERGA members' research outputs, we must consider how we can align our work to the work of policymakers, educational leaders, and teachers. Is it a question of simply focusing on impact, or should we reflect on whether we are asking the right questions? What has led to the use of the narrow evidence-base that is now influencing the practice of mathematics education? Whose

problems are we trying to solve, and is there a mismatch between the problems we are identifying and the problems identified by those who are driving policy?

> In educational research, "What works" is usually the wrong question because almost anything works somewhere, and nothing works everywhere. A better question is, "Under what circumstances does this work", which is why using research to improve education cannot be achieved by slavishly following a recipe dictated from...a "sovereign". Instead, stakeholders need to become critical consumers of educational research" (Wiliam, 2019, p.137).

It is feasible that those who are driving the current agenda in mathematics education are seeking a simple, cost-effective, scalable solution to what is, essentially, a wicked problem exacerbated by a 'perfect storm' of events including teacher shortages, concerns over student performance, and a failure to close equity gaps. While the motivations are sincere (we all share the same goal of improving mathematics education) the solution is reductionist, ignoring the complexity and nuance of the problem that can only be solved by paying attention to individual school contexts and the seeking of solutions from a broad base of mathematics education research evidence, and including evidence sourced from practitioners.

Understanding the problems of practice from the perspective of practitioners is critical if we are to have increased impact. In an editorial focused on improving the impact of educational research, Cai et al., (2017) explore reasons for the divide between research and practice and they suggest that problems identified by school leadership or systems do not necessarily align with teachers' problems of practice. Similarly, the problems we are trying to solve as researchers may not be aligning with the problems that need solving in systems, schools and classrooms, creating or even expanding the gap between research and practice. To this end, Cai et al. (2017) argue that we must "carefully examine the way teachers are positioned in efforts to improve the impact of research" (p. 4). They emphasise the importance of integrating practitioners into the research community, fostering collaboration to identify problems and develop contextually adaptive solutions.

In a similar vein, Lingard (2013), suggests that for educational research (research *for* rather than *on* education) to have impact and improve education policy and professional practice, educational researchers require a "pedagogical disposition", and practitioners should have a "researchly disposition" meaning practitioners should be research-informed and research-informing. It is clear from the recent RIMEA publication that many MERGA members have a pedagogical disposition, so perhaps we should consider how we can work to increase or scale up research and initiatives such as the MERGA Teacher Reads to promote a researchly disposition, along with a more concerted effort to include practitioners as co-researchers.

## Shaping the Future of Mathematics Education

In the current landscape of mathematics education, the translation of research findings into effective policies and practices presents significant challenges. In this paper I have provided a discussion on the current debates, and I have posed some questions to be considered. I now return to MERGA's vision statement which is supported by two aims: a commitment to grow our research community, and a commitment to shaping the future of mathematics. The latter aim directly relates to the content of this paper and I conclude with some practical suggestions and thoughts.

> MERGA is committed to shaping the future of mathematics education by:
>
> - Ensuring MERGA publications are accessible to stakeholders, including policy makers, researchers and teachers.
> - Seeking to influence decision makers to take account of research findings in mathematics education.
> - Maintaining liaison with other organisations with interests in mathematics education or educational research and,

- Promoting social justice research in mathematics education. (MERGA, n.d.)

Finding opportunities to communicate and collaborate directly with decision makers is a significant challenge. MERGA has used the opportunity to provide feedback, as stated earlier, however without sustained communications it is difficult to exercise influence. Collaborations with other bodies such as AAMT in Australia and equivalent associations internationally (e.g. NZAMT in New Zealand) will present a united front and give everyone a stronger voice. Likewise, opportunities to conduct research with policymakers and for policy making should be a goal of MERGA.

MERGA's commitment to making publications accessible is commendable. The accessibility of conference proceedings and the format of conference papers allows all stakeholders access to MERGA research. The translation of MERGA Teacher Reads and their dissemination to teachers via the AAMT provides a valuable opportunity to introduce teachers to MERGA. These communications could be enhanced by adding actionable insights for policymakers, leaders, and teachers. Targeted, accessible summaries of research findings can be disseminated directly to policymakers. Similarly, the publication of easy-to-read syntheses of RIMEA chapters for dissemination to stakeholders would improve MERGA's standing as the lead body in mathematics education research in this region. Leveraging opportunities that are presented through the activities of other like-minded organisations such as the AAMT Strength in Numbers podcast could assist in disseminating research findings to a broader audience.

Competing political and practical priorities that result in the cherry picking of research to align with existing policy agendas make it difficult for MERGA studies to gain traction. This, in conjunction with the discontinuity that arises from the political cycle, will continue to result in challenges for MERGA, however we must continue to work towards having a stronger influence on the current landscape of mathematics education. We must work to release the pedagogy pendulum, and we must be reminded that MERGA does not simply consist of its executive members. *We* are MERGA, and together we need to work towards influencing policy and practice that is informed by a balanced evidence base that includes high quality mathematics education research.

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