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TALKING POINT:

HOW DOES THE USE OF CALCULATORS IN PRIMARY SCHOOLS AFFECT MATHEMATICS LEARNING?

IN SUMMARY

- Early use of calculators is advocated by research but there are gaps due to policy issues
- Pupils with unrestricted access to calculators from an early age don't appear to rely on them
- Calculators can be used for multiple purposes, including creative exploration and detecting pupil misconceptions in number
- Mathematical task design should carefully attend to calculator use
- Calculators should be a catalyst for redesigning curricula, not just add-ons to existing ones
- Use of calculators in primary maths may make the subject more open and interesting for pupils

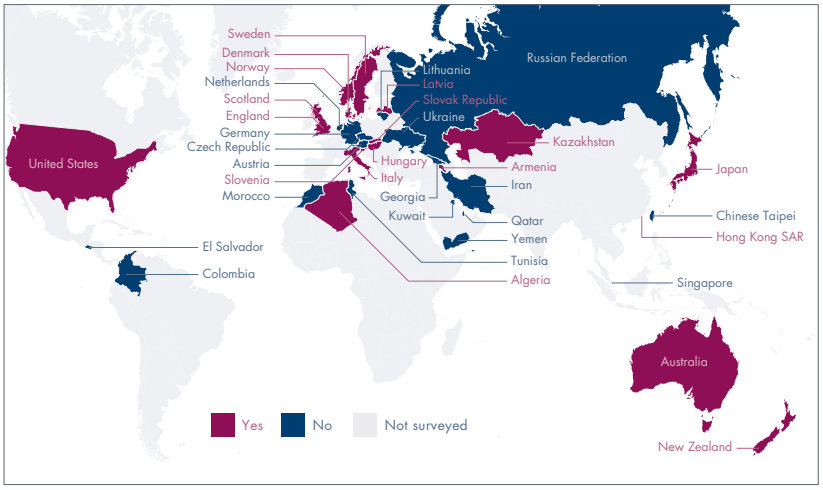
'These children…went determinedly in abstract directions, experimenting with all the buttons on all the numbers they could think of'

CAN project teacher, 1989

'So if the machines can perform calculations, what is left of mathematics? Almost everything. Machines cannot do argumentations, reasoning, conjectures, proofs…'

Ferrara et al, 2006

Do countries mention calculators in their national curriculum at age 10?



Source: TIMSS 2007

1

There is a tension in thinking around (simple) calculator use in the primary classroom; while they are seen as useful and important, particularly in early education and play[1,2], there are also concerns that they can be a crutch[3] or a 'black box' rather than a learning aid.[4] Calculator use from an early age has been advocated for decades by a body of research[1], including the influential Calculator-Aware Number (CAN) Curriculum project 1985–1989 in the UK[5]. This project showed no clear overall long-term effect on later pupil outcomes[6]; however the Australian Calculators in Primary Maths project found that those with long-term experience of calculators showed improvement in concepts of number, especially place value[6]. However, comparative studies have been limited and access to calculators at home – which is likely to be strongly linked to socio-economic status[1] – is a significant factor. Pupils in the CAN project (compared to non-CAN pupils) were more likely to use mental calculation than calculators afterwards – and to choose more efficient and powerful strategies[4]; other studies have shown pupils with unrestricted access to calculators in the classroom don't appear to rely on them.[6] Research in this area has been restricted by the constraints and recommendations of national curricula and national assessments.[4]

IMPLICATIONS: Research advocates the benefits of early calculator use in maths education but the long-term performance outcomes aren't always clearly improved

There is a gap in the research into early calculator use as it is often restricted by national policy

Use of calculators in primary school may help to develop concepts of number, especially place value

Unrestricted classroom access to calculators from an early age does not appear to make pupils reliant on calculator methods

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2

Prevalent ideas of calculator use in maths lessons may be unfairly restricted to results checking or complex computation[11] – calculators can also be helpfully used in formative assessment and detection/diagnosis of misconceptions, provided task design is carefully structured around calculator use ('calculator-mediated task design'), for example, using frameworks such as *Observe-Predict-Surpass* (and many others).[4] Calculators can be used for 'sense-making activity'[7]; to find patterns and to allow pupils to explore or investigate 'how numbers work'; and to deal with 'real-life situations in which the numbers have not been simplified'.[3]

IMPLICATIONS: Calculators can be used for a variety of purposes in maths learning, such as making meaning, exploring patterns or detecting misconceptions about number

Tasks should be carefully designed around calculator use to maximise learning opportunities

3

The calculator can be seen as a way to help pupils see mathematics differently – to change the narrative from a 'precise, tightly structured subject' to a more open and, for many, interesting[2] subject in which students are more able to apply their learning to real-life situations.[7] Calculators might be capable of not only supporting but 'reamplifying and reorganising' thought about mathematics[8] – creating a 'new intellectual infrastructure'.[9] Primary-age students state that use of calculators makes mathematics more attractive and they perceive it as easier.[10] For adults there may be 'contrasting views between their own use of calculators and their appropriate use in the classroom'[2] and that teachers often 'hesitate'[11] to use calculators in the classroom. In one study, 96% of teachers supported calculator use in primary maths but only 36% actually used them.[11]

IMPLICATIONS: Use of calculators can promote more positive thinking from pupils about mathematics as a subject

There may be a gap between thinking about calculators for personal use and implementation in the classroom

4

It has been argued that calculators should be used in the classroom but may only be done so successfully with an innovated curriculum as opposed to just an 'add-on' – considering use of calculators can be a catalyst for reconsidering why and how maths is taught.[12,3,7] Other views suggest that students should learn how to do the relevant calculations first and only then can they progress to calculator use in the appropriate area.[14] Of 35 countries reviewed, only half mentioned calculators in their national curriculum at age 10 (see infographic).[13] Teachers also tend to follow the expectations of textbooks rather than research or curriculum framework guidance when it comes to calculator use.[15]

IMPLICATIONS: Calculator use is not always referenced in national curricula

Embedding and designing calculator use in a curriculum is preferable to using them purely as a tool alongside existing curricula

Teachers tend to follow textbook recommendations on calculator use; these should therefore be carefully considered by textbook designers

Lucy Rycroft-Smith, 2017

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