

# Calculators: Friend or foe?

Jeremy Hodgen and Colin Foster discuss the place of calculators in the classroom.

Parents and politicians frequently worry that using calculators in the school classroom might de-skill learners and prevent them from thinking for themselves and developing mental and written methods of calculation. Is this a valid concern? In our recent work on a guidance report on mathematics teaching for the Education Endowment Foundation (EEF, 2017), entitled *Improving Mathematics in Key Stages Two and Three*, we looked at the evidence for the effects of calculator use on learning. We found that appropriate use of calculators can improve learners' understanding of mathematics, and that, when taught well with calculators, learners actually used them *less* (Ruthven, 1998). Using calculators in considered and thoughtful ways seems to be particularly important with younger learners, and although we recommend that primary-age learners should not generally be using calculators every day, we believe that they should be using calculators frequently.

We think that it is important that calculators are not used to compensate for learners' numeracy difficulties, because then they could prevent learners from addressing those difficulties. No-one wants to see learners dependent on using a calculator to calculate  $2 \times 10$ . Instead, we think that calculators should be used to support deeper thinking about mathematics. Here are some examples of the kinds of calculator use we think are valuable:

*Use estimation to "Beat the calculator":* One learner finds the answer mentally more quickly than another learner does by typing into the calculator. Learners could be asked to generate examples of calculations that they can do more quickly mentally than on a calculator. A simple example would be  $1.5 \text{ billion} + 1.5 \text{ billion} = 3 \text{ billion}$ , which would take longer to type into the calculator than it would to think about. Older learners could tackle calculations such as  $\frac{222\ 222\ 222\ 222^2}{444\ 444\ 444\ 444}$ , which some calculators will not get exactly right, by building up patterns starting from  $\frac{22^2}{44}$  and also by thinking about it as  $(\frac{2 \times 111\ 111\ 111\ 111^2}{4 \times 111\ 111\ 111\ 111})$  (Foster, 2010, p. 25).

*Support problem solving involving calculations with realistic numbers:* Before calculators appeared in classrooms, the numbers in problems had to be contrived to make calculation simple. This sometimes meant that the operation needed could be guessed based on the particular numbers chosen. With calculators, we can give learners problems involving much more realistic numbers, which avoids giving away clues, and means that learners have to think more carefully about the structure of the problem.

Taking away the burden of tedious calculation allows learners to focus on wider aspects of the problem, and consequently to tackle more challenging problems.

*Explore number patterns using the constant key:* Learners are required to predict, describe and explain, not just press a key unthinkingly. For example, if we enter 5 and then keep on adding 3s, will we ever get to exactly 100? If we enter 100 and then keep on dividing by 2, will we ever get to exactly zero?

*Explore multiplicative structure by trial and improvement calculations:* For example, young learners could be asked what number they would have to multiply 8 by to get 18. They could experiment on their calculators, maybe starting with 2 and gradually homing in on the correct value. Afterwards, they could work on justifying why  $2.25$  must be the right answer and seeing that this is  $18 \div 8$ .

An important goal is for learners to make sensible choices about when, and when not, to pick up a calculator. It can be helpful to ask learners for the same problem, "What would be a good mental way to do this? What would be a good written method? What would be a good method on a calculator?" For example, to increase £40 by 15% mentally, a learner might find 10% and 5% and add those to the original £40. But, using a calculator, they could just do  $40 \times 1.15$  in one step.

---

**Jeremy Hodgen is Professor of Mathematics Education at UCL Institute of Education. He can be contacted at [jeremy.hodgen@ucl.ac.uk](mailto:jeremy.hodgen@ucl.ac.uk).**

**Colin Foster is an Associate Professor at the University of Leicester. He can be contacted at [colin.foster@leicester.ac.uk](mailto:colin.foster@leicester.ac.uk).**

---

## References

Education Endowment Foundation (2017). *Improving mathematics in key stages two and three*. London: Education Endowment Foundation. Available from: [https://educationendowmentfoundation.org.uk/public/files/Publications/Campaigns/Maths/KS2\\_KS3\\_Maths\\_Guidance\\_2017.pdf](https://educationendowmentfoundation.org.uk/public/files/Publications/Campaigns/Maths/KS2_KS3_Maths_Guidance_2017.pdf).

Foster, C. (2010). *Resources for teaching mathematics 14–16*. London: Continuum.

Ruthven, K. (1998). The use of mental, written and calculator strategies of numerical computation by upper primary pupils within a 'calculator-aware' number curriculum. *British Educational Research Journal*, 24(1), 21-42.

---

The attached document has been downloaded or otherwise acquired from the website of the Association of Teachers of Mathematics (ATM) at [www.atm.org.uk](http://www.atm.org.uk)

Legitimate uses of this document include printing of one copy for personal use, reasonable duplication for academic and educational purposes. It may not be used for any other purpose in any way that may be deleterious to the work, aims, principles or ends of ATM. Neither the original electronic or digital version nor this paper version, no matter by whom or in what form it is reproduced, may be re-published, transmitted electronically or digitally, projected or otherwise used outside the above standard copyright permissions. The electronic or digital version may not be uploaded to a website or other server.

Any copies of this document MUST be accompanied by a copy of this page in its entirety. If you want to reproduce this document beyond the restricted permissions here, then application must be made for express permission to [copyright@atm.org.uk](mailto:copyright@atm.org.uk)

*ATM is a not for profit professional teaching association. The majority of funding used to produce and prepare the MT journal is procured through our membership subscriptions.*



Mathematics Teaching does not seek to conform to an 'official' view on the teaching of mathematics, whatever that may be. The editorial board wishes to encourage contributors to express their personal views on the teaching and learning of mathematics.

ATM is an association of teachers in which everyone has a contribution to make, experiences and insights to share. Whether practical, political, philosophical or speculative, we are looking for articles which reflect on the practice of teaching mathematics. We aim to publish articles that will be of interest to the breadth of our membership, from the Foundation Stage to Higher and Further Education; as well as a balance between those derived from research and from practical experience. Submitted articles are accepted for publication based on their clarity, topicality, the extent to which they reflect upon knowledge and understanding of mathematics teaching and learning, and their contribution to inspiring further development and research.



Join ATM at any time and receive twelve months of membership, including instant access to member discounts and resources. Spread the cost and pay in ten monthly instalments.

**Membership Includes:**

- Five copies of the ATM journal Mathematics Teaching (MT)
- A 25% discount on all shop items
- Considerable discounts at the hugely popular annual ATM conference
- Electronic access to thousands of online MT journal articles
- Access to all online member-only resources
- Professional support and enrichment – being part of a community where ideas are generated and shared
- Regular ATM e-newsletters, containing current news and activities
- A network of local branches offering regular meetings
- Accreditation - ATM is proud to offer members the opportunity to apply for the CMathTeach Designation, making ATM membership the route to Chartered Mathematics Teaching status
- Influence and having a voice - eligibility to vote on resolutions that shape the direction of ATM

**Join ATM Today**