

From the Library

Are you interested in improving attainment in algebra and multiplicative reasoning? Are you worried about the Key Stage 3 dip? ICCAMS Maths may be the answer!



Professor Jeremy Hodgen, Director of the ICCAMS Maths project at the University of Nottingham, explains what ICCAMS Maths is and how you can get involved in the new Education Endowment Foundation funded project.

If you, like me, are worried about progression in mathematics at Key Stage 3, then you will be interested in the [ICCAMS Maths project](#). In 2008, I was able to secure funding from the Economic and Social Research Council (ESRC) to work with Professor Margaret Brown, Professor Rob Coe, Dr Dietmar Küchemann and a group of teachers to develop an innovative and evidence-based approach to maths teaching. Increasing Competence and Confidence in Algebra and Multiplicative Structures, or ICCAMS Maths, the result of this research, draws on more than 40 years of research into learning and teaching school mathematics. It is designed to raise attainment in maths by helping teachers to use formative assessment to improve teaching and learning at Years 7 and 8.

ICCAMS Maths uses meaningful and intriguing contexts, whilst enabling teachers to probe how students understand maths. For example, the first ICCAMS algebra assessment task poses the question, "Which is larger: $3n$ or $n+3$?" Most Key Stage 3 students do not say that it depends on the value of n . Instead, most say that $3n$ must be larger "because multiplication makes things bigger". This assessment task is followed by a lesson in which students compare two expressions in a 'realistic' context about hiring a boat.

Algebra: Lesson 1A

Boat Hire

Olaf is spending the day at a lake.
He wants to hire a rowing boat for some of the time.

Freya's Boat Hire charges £5 per hour.
Polly's Boat Hire charges £10 plus £1 per hour.

Whose boat should Olaf choose?

The Boat Hire problem is 'realistic' in the sense that students can imagine such a scenario and think their way into it, even though they might never have encountered such a problem in real life, and perhaps never will. Almost all of the students that we have worked with have the task engaging, because they could make sense of it and because initially they came up with different conclusions which had to be resolved.

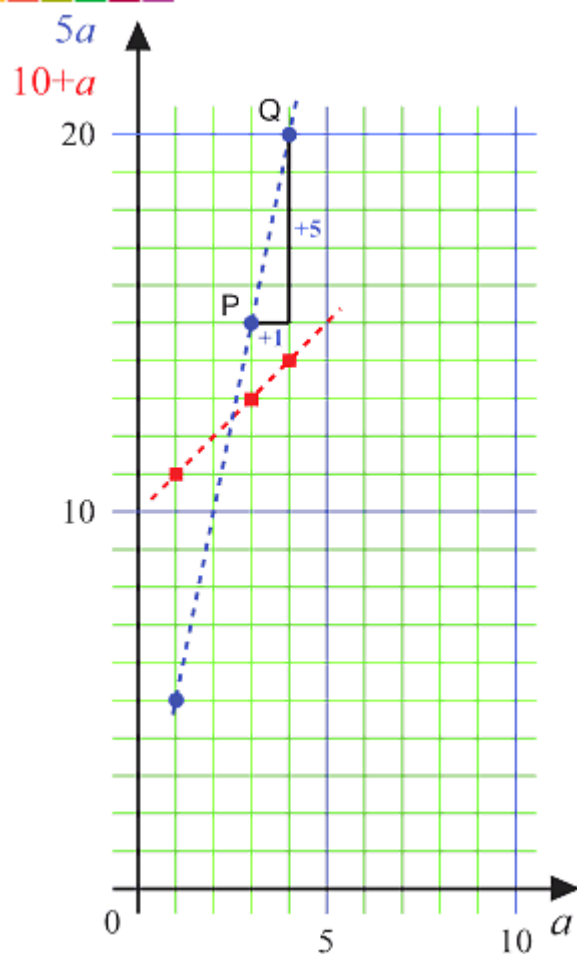
After a brief period of discussion, as a class and in small groups, the teacher is asked to record on the board the numerical data that students come up with to support their arguments. The data are first recorded 'randomly' and then (hopefully prompted by the students themselves) in an ordered table.

Students are used to using ordered tables, but this gives them an opportunity to see why such an ordering can be helpful.

Reproduced below is a pair of students' work, who, having ordered the data, noticed a pattern in the differences between Polly's and Freya's rates (-6, -2, +2, +6). Observations like this can prompt the question 'Are the hire costs ever the same?'. One way we suggest of pursuing this is to represent the relations algebraically (e.g., $5a$ and $10 + a$), which might lead students in some classes to consider how to solve the equation $5a = 10 + a$.

	P	F
1 hour	£11	£5
		-6
2 hours	£12	£10
		-2
3 hours	£13	£15
		+2
4 hours	£14	£20
		+6

Students are then asked to put the data on a (Cartesian) graph. This representation is quite abstract (the 'picture' isn't of boats on a lake). But, because the graph is about a by-now familiar story, students are in a good position to relate salient features of the graph to the story and also to the other representations they have used. One such feature is the point where the two dotted lines cross; another might be the gradient of the lines (what does this tell us, and how is the same thing shown in a table or algebraic expression?); or the point where a line crosses the y-axis (or, indeed, the x-axis!); or can lines meaningfully be drawn through the points (what do the intermediate points represent, and do the resulting points satisfy the relation in the table or algebraic expressions?).



The general idea is to give students the opportunity to see that a graph can be meaningful and useful. Some students have even ‘remembered’ the Boat Hire problem in a later lesson and decided spontaneously to draw a graph to compare two expressions!

I do hope that you – like teachers that we have worked with - find the ICCAMS Maths approach interesting and potentially valuable. We have now been funded by the Education Endowment Foundation to conduct a major national research project to work with Durham University, the University of Manchester, NCETM and a number of Maths Hubs. This project, which is now recruiting schools, will conduct a large randomised controlled trial to evaluate the effects of ICCAMS Maths on student attainment.

If you are interested in getting involved in this trial, please do contact ICCAMS (see below).

And finally ... some answers to some frequently asked questions about ICCAMS Maths:

Does ICCAMS work?

In the original ESRC-funded research study, we tested ICCAMS in 22 classes from 11 schools and found that the rate of learning for students in ICCAMS Maths classes was double that for students compared to a control group. The current trial is intended to evaluate whether ICCAMS Maths works at scale across a range of different schools.



Does ICCAMS Maths encourage mastery?

Our aim is that students will become fluent with maths and will be able to tackle non-routine problems successfully. We emphasise ways of ensuring that students develop conceptual understanding.

Can ICCAMS Maths be used alongside my school's existing scheme of work?

ICCAMS Maths is designed to supplement, not replace, ordinary lessons. The programme meets the requirements of the new National Curriculum and has been used with many different schemes of work (and many different textbooks).

Is ICCAMS Maths appropriate for low and high attainers?

ICCAMS Maths caters for all students across the attainment range and the lessons have been trialed in a wide range of different classes. The programme is designed to help you improve teaching and learning across all lessons and for all students by assessing what your students understand, what they find difficult and what they need to learn next.

What does ICCAMS Maths involve?

ICCAMS Maths is a two-year-programme consisting of 10 short mini-assessment tasks and 10 pairs of lessons in each of Year 7 and Year 8. We provide ICCAMS mini-assessment and lesson materials, professional development for two teachers, training materials for a school's whole maths department and ongoing support from an expert PD Lead.

How can I find out more?

Via the [ICCAMS website](#), or contact Clare Collyer, Administrator - by [email](#) or phone 0191 334 4682.

Image credit

[Page header](#) by [Caio Resende](#) (adapted), [in the public domain](#)