

- For secondary maths teachers

COGNITIVE SCIENCE: MATHEMATICS PRACTICE

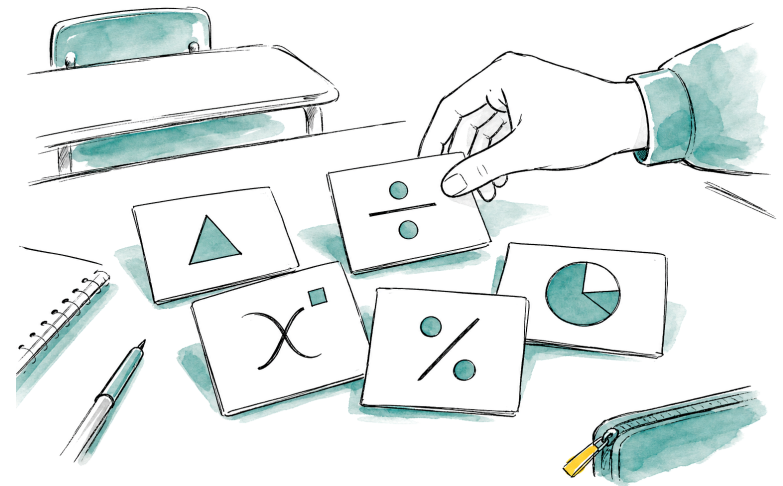
Why mixing maths problems beats practising one type at a time

Evidence from a large US classroom trial (Florida Grade 7 maths), worth watching for UK Key Stage 3 practice.

A large classroom trial found Grade 7 maths learners who mixed practice problems scored 61% on a test a month later, against 38% for learners who practised one type at a time, though it took more time and the researchers flag real caveats.

● ● ● Evidence: Secure

Independent replications across UK curricula, subjects and age groups, plus tests of delayed outcomes, feedback and prior blocked grounding.



WHAT HAPPENED

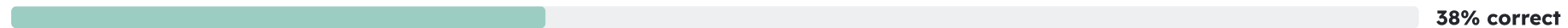
Mixing problem types raised test scores by a wide margin

Researchers randomly assigned 54 real Grade 7 maths classes (787 learners, 15 teachers, 5 Florida schools) to either mixed or one-type-at-a-time practice worksheets over four months. Both groups then completed an identical mixed review worksheet, and a month later sat an unannounced test. Learners who had done more mixed practice scored 61% on that test, against 38% for learners who mostly practised one type at a time, a large and statistically reliable difference ($d = 0.83$) that held for every one of the 15 teachers.

Mixed practice



One type at a time



Test taken one month after the last practice worksheet, with no warning it was coming, so the scores reflect what learners kept, not what they'd just crammed. The researchers call this a large effect ($d = 0.83$, 95% CI 0.68 to 0.97), one they say seems surprisingly big for a classroom experiment, and think it happens because mixed practice combines three memory boosts at once: choosing the right method, spacing out each skill, and recalling it from memory rather than being told which one to use.

What "mixing" means in practice

1

No two questions the same

Consecutive problems in a worksheet never use the same method, so learners must work out which one applies each time.

2

Still needs feedback

Learners saw worked solutions and corrected their own mistakes after every worksheet. Mixing was tested together with feedback, not instead of it.

3

Built on some blocked practice first

Learners had already met each method through ordinary teaching before the mixed worksheets began. Mixing was not their first exposure to any of it.

Across your subjects and classes

This trial tested maths worksheets in one US school district. What follows are sensible ways the same mixing idea could work in other subjects and UK classrooms, worth trying, not proven.

Subject	How it could translate
Maths	Build revision and homework sets so no two consecutive questions use the same method, e.g. alternate fractions, ratio and algebra questions rather than a block of each.
Science	Mix calculation types in a practice set (moles, speed, circuit questions together) instead of a block of one formula at a time, once each has already been taught.
MFL	Mix verb tenses or grammar points within one exercise instead of drilling a single tense, once learners can already form each one on its own.
English and humanities	Mix exam-style question types in a revision set (source analysis, essay-planning, short-answer questions together) rather than working through one type at a time.

Adapt it to the class in front of you

Confident with each method separately

The easiest place to start. Mix your next revision or homework set once every method involved has already been taught on its own.

A lower-attaining or foundation group

Teachers in the trial rated mixed practice as suitable here too, but flagged it as slightly harder and slower, so build in more feedback time.

Still learning a method for the first time

The trial did not test this directly. The researchers' own caveat: mixing may be too hard before learners have some grounding in a method first.

A top set or higher-attaining group

Teachers also rated mixed practice as suitable here. This may be an easy place to start, since novelty is less likely to overwhelm.

A large, well-controlled classroom trial

Firm

This rates the evidence's firmness, not our endorsement of the idea. A preregistered, randomised trial across 54 real classes, 787 learners and 15 teachers found a large, consistent effect, with a positive result for every single teacher.

- One country, one age group, one subject: Florida Grade 7 maths classes, in the 2017-18 school year. We don't yet know how strongly the same effect holds in other subjects, age groups, or UK classrooms.
- The higher scores came with more effort. Every teacher reported that mixed worksheets took longer, and most said their learners found mixed practice slightly harder and slightly more time-consuming than one-type-at-a-time practice.
- Mixed practice was tested alongside feedback (learners saw worked solutions and corrected mistakes) and after learners had already met each method through ordinary teaching. The trial doesn't tell us whether mixing alone, without feedback or without some grounding first, works as well.

What that means for you: treat "mixing different problem types beats blocking by topic" as a strong, well-tested finding in maths, one that a large randomised trial can support. Treat the ideas for other subjects on page 3 as sensible extensions worth testing, not separately proven.

TRY IT THIS WEEK

Your first small step

THIS WEEK

Before your next revision or homework set, rebuild it so no two consecutive questions use the same method, once every method involved has already been taught.

Try it and watch: notice which learners suddenly pause to work out which method applies. That's the moment mixed practice is doing its job. The researchers' own conclusion: *"although important caveats remain, the results suggest that interleaved mathematics practice is effective and feasible."*

Go deeper

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