

# The Curious Case of the Question Mark

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Now extra reliable!  
107,979 participants &  
cross-validation after acceptance



## 1. Take-away

An A/B test in Math Garden showed that delaying access to a problem-skipping option increases effortful practice.

## 2. Good to know

**Math Garden** - A computer adaptive practice system for arithmetics, actively used by over 150,000 primary school children.

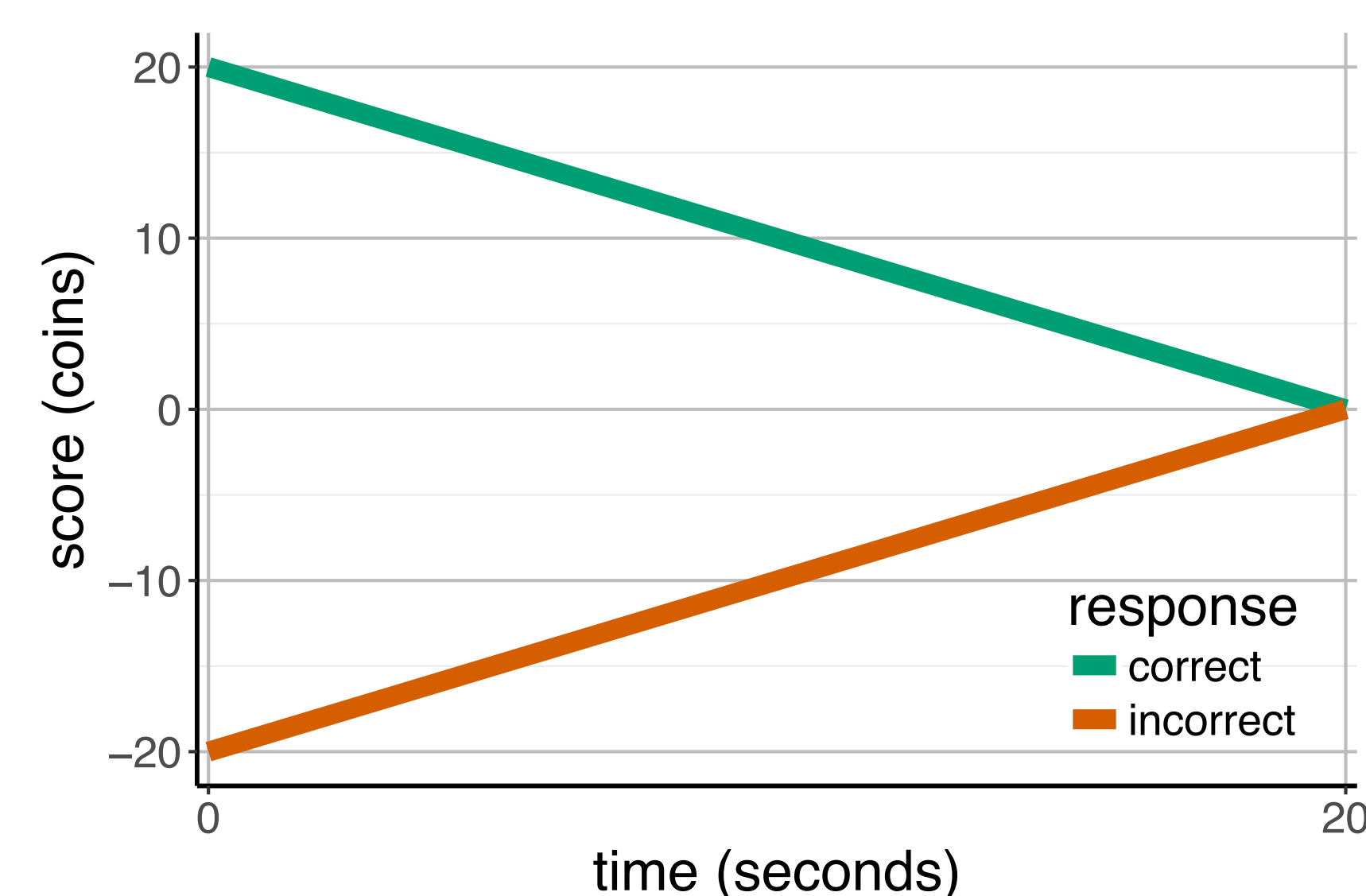
**A/B test** - An online randomised field experiment that usually involves hundreds of thousands participants (also see box A).

**Effortful practice** - Practice that involves deliberate effort and a risk of failure. Important for learning.

## 3. The problem

In Math Garden, some children skip problems **without taking the effort** to solve them.

One possible reason: obsession with collecting virtual coins (requires fast correct responses).



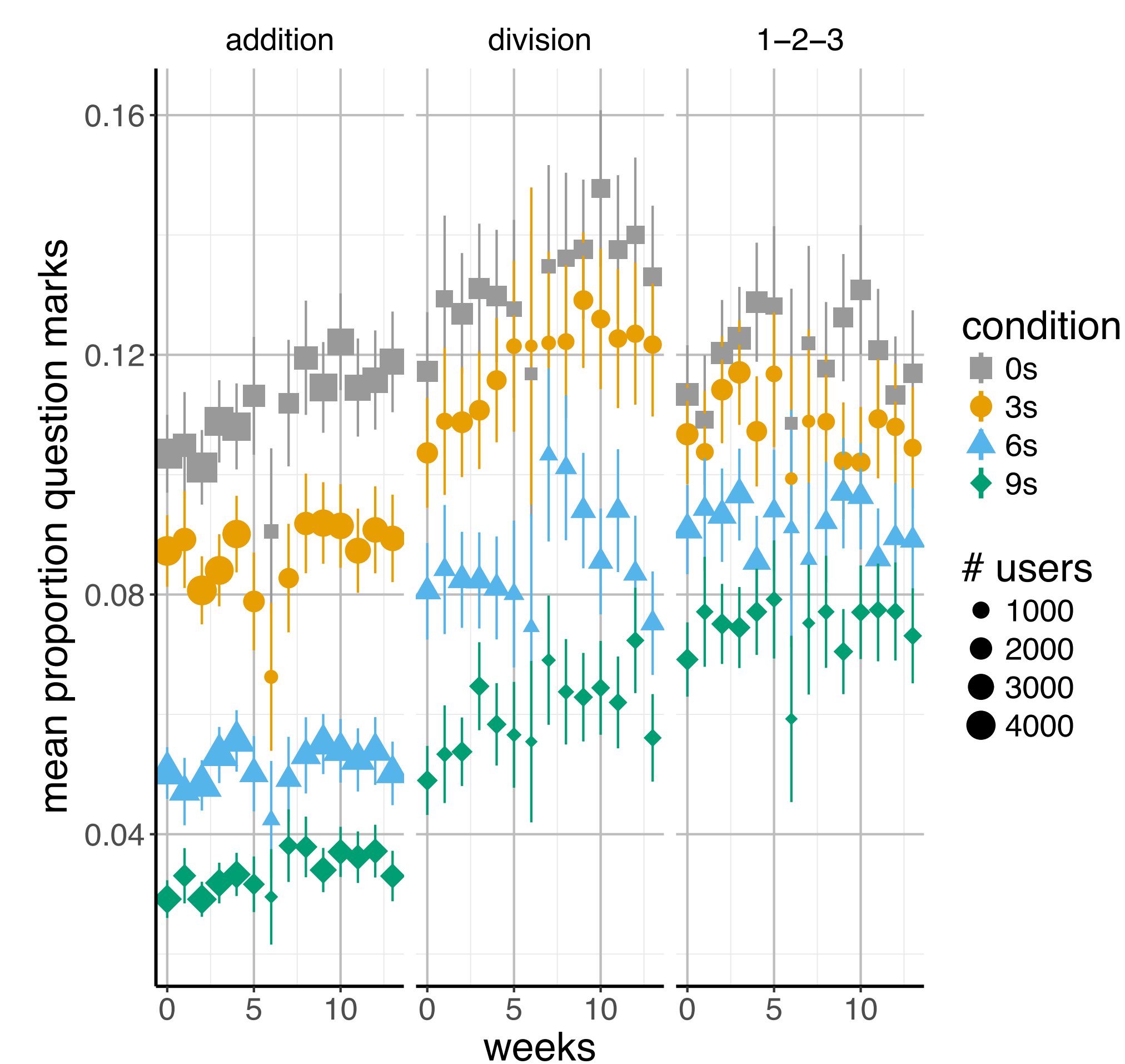
Their strategy: if item is too difficult, quickly hit **question mark button** (no penalty) and proceed to next item.

## 4. Our solution

Delay appearance of the question mark by 3, 6, or 9 seconds (default is 0 seconds). This is the **minimum toil time**. Experimental details in box B.

## 5. Results

Fewer question mark responses:



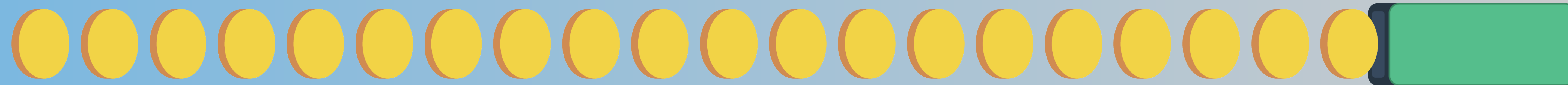
## 6. Should you care?

We think so. This is why:

- \* Intervention is **minimally invasive**.
- \* Yet, children seem to **exert more effort** (see box C).
- \* Potentially affects 150,000 children.
- \* Minimum toil time might be advantageous in other settings.
- \* We love **reliability**: many participants & cross-validation is postponed until after acceptance, to shift focus to the quality of the methods.



Example:  $9 \times 9 = \dots$



**Box A. Are A/B tests pure awesomeness?** Definitely.

- \* Massive scale
- \* High ecological validity
- \* Double blind
- \* Minimally invasive

**Box B. The experiment by the numbers.**

- \* 107,979 participants
- \* 4 conditions: 0, 3, 6, or 9 seconds delay
- \* 3 domains: addition, division, 1-2-3
- \* 14 week experiment span

**Box C. Do children exert more effort?** Probably.

- \* Fewer question mark responses
- \* Time on task does not decrease
- \* Fast guesses are unlikely
- \* Substitute responses are slow

**Further information**

Title: *Delaying access to a problem-skipping option increases effortful practice.*

- \* Read the paper: [osf.io/preprints/socarxiv/m6jqe/](https://osf.io/preprints/socarxiv/m6jqe/)
- \* Get in touch: [alexandersavi.nl](mailto:alexandersavi.nl)

