Summary

Rohrer, D., Dedrick, R. F., & Stershic, S. (2015). Interleaved practice improves mathematics learning.
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Introduction

Nearly any mathematics problem includes two steps, as illustrated by the following problem.

Zoe kayaks 8 km east and then 15 km north.
How far is she from her starting point?

To solve this problem, students must first infer that they need to use the Pythagorean Theorem, and this is not obvious because the problem does not refer to a triangle or a hypotenuse. Once they have *chosen* this strategy, they can then *execute* the strategy ($8^2 + 15^2 = c^2$, which means that the answer is 17 km).

The choice of an appropriate strategy is often difficult because superficially similar problems sometimes require different strategies. For example, word problems like the one above often lack explicit cues indicating which strategy is appropriate. In algebra, the instruction, "Solve for *x*," does not indicate which of several different strategies is useful.

Although students must learn to choose a strategy, they do not have an opportunity to practice this skill when every practice problem within an assignment can be solved by the same strategy – an approach known as *blocked practice*. With blocked practice, students know the strategy before they read the problem. For example, if a lesson on proportions is followed by a dozen word problems requiring students to create a proportion, students need not learn which features of a problem indicate that it can be solved by a proportion.

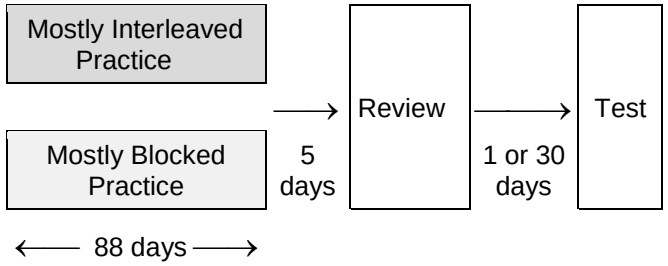
Blocked mathematics practice is prevalent. We examined six middle school mathematics textbook series and found that the large majority of the problems in each textbook appear in a block of problems devoted to the concept introduced in the immediately preceding lesson. Furthermore, the emphasis on blocked practice is even greater in consumable workbooks, which are increasingly replacing textbooks in the classroom.

In an alternative approach that served as the intervention in the present study, the practice problems within a course or textbook are merely rearranged so that a portion of each assignment includes a set of different kinds of problems presented in an intermixed order – a technique known as *interleaved practice.* With interleaved practice, students must learn to choose the strategy on the basis of the problem itself, just as they must do on a cumulative exam or high-stakes test.

Method

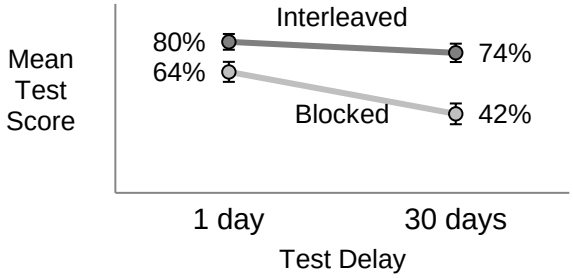
Three math teachers and 126 seventh-grade students participated. The students saw their teachers' usual lessons and received assignments that we created. After each assignment, teachers presented the solutions and asked that students correct their mistakes. An experimenter visited the school frequently to score the assignments. This scoring revealed high fidelity.

Every student received the same problems, but the scheduling of the problems was altered so that students received mostly blocked practice or mostly interleaved practice. Later, every student received the same review, followed 1 or 30 days later by an unannounced test consisting of novel problems.



Results

Interleaved practice (versus blocked practice) produced higher scores on both the immediate and delayed tests (Cohen's *d* = 0.42 and 0.79, respectively).



Summary

A greater degree of interleaved practice produced superior test scores, and this benefit did not fade over time. Given this efficacy, and given the ease with which interleaved practice can be implemented in the classroom, this finding suggests that students should receive more interleaved practice than they typically do.