A simple geometric model provides a quantitative explanation of the advantages of immediate feedback in student learning

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Calculus is a known bottleneck for many students studying science and engineering. Various techniques have been developed to enhance the students' success. A recent study published in the Notices of American Mathematical Society showed that only one factor determines the success of a technique: the presence of immediate feedback. On average, students who receive immediate feedback learn twice faster than students who are taught in a more traditional way, with a serious feedback only once or twice a semester (after a test).

The very fact that immediate feedback is helpful is no surprising: it helps the student clear misconceptions and avoid the wrong paths. However, the fact that different techniques involving feedback lead to practically the same learning speed-up is intriguing. To explain this speed-up, we provide a simplified description of a learning process in simply geometric terms, and we show that this description indeed leads to the observed twofold speed-up.