

**IMPROVING PROBLEM SOLVING WITH RETRIEVAL-BASED
LEARNING**

by

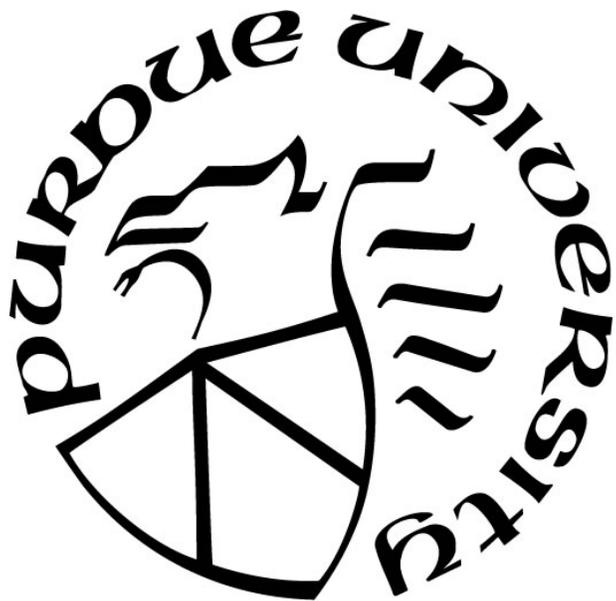
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ABSTRACT

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Recent research asserts that the mnemonic benefits gained from retrieval-based learning vanish for complex materials. Subsequently, it is recommended that students study worked examples when learning about complex, problem-centered tasks. The experiments that have evaluated the effectiveness of studying worked examples tend to overlook the mental processing that students engage in when completing retrieval-based learning activities. In contrast, theories of transfer-appropriate processing emphasize the importance of compatibility between the cognitive processing required by the test and the cognitive processing that is activated during learning. For learners to achieve optimal test performance, according to transfer-appropriate processing, they need to study in such a way that they are engaging in the same mental processing that will be required of them when tested. This idea was used to generate testable predictions that compete against the claim that the retrieval practice effect disappears for complex materials, and these competing predictions were evaluated in three experiments that required students to learn about the Poisson probability distribution.

In Experiment 1, students learned the general procedure for how to solve these problems by either repeatedly recalling the procedural steps or by simply studying them. The retrieval practice condition produced better memory for the procedure on an immediate test compared to the study only condition. In Experiment 2, students engaged in the same learning activities as Experiment 1, but the test focused on their problem-solving ability. Students who practiced retrieval of the procedural steps experienced no benefit on the problem-solving test compared to the study only condition. In Experiment 3, students learned to solve Poisson probability problems by studying four worked examples, by studying one worked example and solving three practice problems, or by studying one worked example and solving three practice problems with feedback.

Students were tested on their problem-solving ability one week later. The problem-solving learning activities outperformed the worked example condition on the final problem-solving test. Taken together, the results demonstrate a pronounced retrieval practice effect but only when the retrieval-based learning activities necessitated the same mental processing that was required during the final assessment, providing support for the transfer-appropriate processing account.