This document provides a summary of Recommendation 2 from the WWC practice guide *Organizing Instruction and Study to Improve Student Learning*. Full reference is on the last page.

CONTENT **General**

GRADE LEVEL(S) **K-12**

LEVEL OF EVIDENCE **Moderate**

Recommendation

Interleave worked example solutions and independent problem-solving exercises.

When teaching problem-solving, teachers could interleave worked example solutions and problem-solving exercises—literally alternating between worked examples demonstrating one possible solution path and problems that the student is asked to solve for himself or herself. Research has shown that this interleaving markedly enhances student learning.

How to carry out the recommendation

Alternate between working with already worked solutions and solving problems independently.

South Carolina standards alignment

TEACHERS: INST.T.1.1-4, INST.PS.1-9
ACADEMIC STANDARDS: ELA.K-12.I.3, M.K-12.MPS.PS.1, SCI.K-12.S.1

Students learn more by alternating between studying examples of worked-out problem solutions and solving similar problems on their own than they do when just given problems to solve on their own. The amount of guidance and annotation will vary depending on the situation and the student. Consider varying the amount of guidance and support.

Use partially solved problems to transition to independent problem-solving.

South Carolina standards alignment

TEACHERS: INST.T.1.1-4, INST.PS.1-9
ACADEMIC STANDARDS: ELA.K-12.I.3, M.K-12.MPS.PS.1, SCI.K-12.S.1

As students develop greater expertise, decrease the use of examples and increase independent problem-solving. Try using partially solved problems by giving early steps in a problem and requiring students to provide more and more of the later steps as they acquire more expertise with the problem type.

3. Vary the requirements between worked examples and independent problems.

South Carolina standards alignment

TEACHERS: INST.T.1.1-4, INST.PS.1-9
ACADEMIC STANDARDS: ELA.K-12.I.3, M.K-12.MPS.PS.1, SCI.K-12.S.1

As students develop greater expertise, ask students to independently solve problems that vary from the worked example. (e.g., changing both the values included in the problem and the problem formats).

Potential roadblocks and how to address them

Roadblock	Suggested Approach
Curricular materials do not often provide teachers with large numbers of worked example solutions.	Teachers can work together on teams to prepare homework sets that interleave worked examples with problems for students to solve. Teachers can take worked examples included in the instructional section of the textbook and interleave them into the assigned homework problem sets.
Teachers may be concerned that by providing large numbers of worked-out examples to students, they will memorize the solution sequences and not attain mastery of the underlying concepts being taught and reinforced through this interleaving technique.	By having problems to solve in between the worked examples, students are motivated to pay more attention to the worked example because it helps them prepare for the next problem and/or resolve a question from the past problem. Having problems to solve helps students recognize what they do not understand. Students are notoriously poor at identifying what they do not understand (see Recommendation 6 for a discussion of learners' "illusion of knowing"). By interleaving worked examples with problems to solve, students are less inclined to skim the example because they believe that the answer is obvious or they already know how to solve this type of problem.

For more information on the research evidence and references to support this recommendation, please refer to sources cited here:

Pashler, H., Bain, P., Bottge, B., Graesser, A., Koedinger, K., McDaniel, M., and Metcalfe, J. (2007) *Organizing Instruction and Study to Improve Student Learning* (NCER 2007-2004). Washington, DC: National Center for Education Research, Institute of Education Sciences, U.S. Department of Education. Retrieved from http://ncer.ed.gov.