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Institute of
Education Sciences

What are some evidence-based strategies based on cognitive science that help students develop deep understanding of new concepts?



Selected Evidence-Based Resources

- Empirical studies of [writing interventions](#) with students in grades 5–12 report significant, positive effects for strategies that include engaging students in **setting goals** for learning. For example, [English learners](#) improved their on-demand analytical writing when teachers employed goal-setting strategies.
- **Interleaving** is the practice of using a set of strategies or topics to solve problems during a single practice session, as opposed to using one strategy or topic at a time. Interleaving has been shown to enhance retention and procedural flexibility according to empirical studies on [reading](#) and mathematics interventions for elementary and middle school students. [Grade 7 mathematics](#) students who were taught strategies for solving problems in an interleaved format had better recall.
- Empirical studies of [science](#) and [reading](#) interventions for elementary and middle school students report positive effects for engaging students in **inquiry learning** to support comprehension and conceptual understanding of new learning. For example, students in a physics class could explore their own questions about velocity and record their observations as they experiment with their hypotheses.
- **Schema-based instruction**, or using schematics to identify and summarize key concepts, helps consolidate learning to support elementary and middle school science and math students. Emergent bilingual and monolingual students in middle school significantly increased their [science](#) knowledge and academic English when they used hands-on methods coupled with richly illustrated materials to aid language comprehension. Middle school [math](#) students who learned to resolve ratio and proportion word problems using schema-based instruction earned higher grades on a posttest and a delayed posttest months later than traditionally taught students.
- [Mathematics](#) interventions for middle school students demonstrate positive effects for strategies that **connect new learning with prior learning or personal experience**, and/or include elements of **cueing cognitive interest** in learning. For example, [middle school students with disabilities](#) made significant gains in math using “enhanced anchored instruction” in which they watched short videos of children their age solving real-life math problems. In one video, students figured out how to build a skateboard ramp using materials they could afford on a budget.



Additional Resources



The [IRIS Center at Vanderbilt University](#) offers a wide variety of resources and services to suit a diverse set of instructional needs and circumstances. The Center provides resources on [schema-based instruction](#) and [metacognitive strategies](#) for math instruction.



The [WWC reviewed Self-Regulated Strategy Development \(SRSDD\)](#) to support students with learning disabilities strengthen their writing skills.



The WWC Practice Guide [Organizing Instruction and Study to Improve Student Learning](#) describes evidence-based strategies through examples like interleaving example solutions with problem-solving exercises (Recommendation 2) and using enhanced anchored instruction to combine abstract and concrete examples (Recommendation 4).