The book that inspired millions of educators to ref approach to teaching returns for an all-new third edition.

Built on a more rigorous research base and updated to emphasize s and inclusion, The New Classroom Instruction That Works offers a s the 14 instructional strategies proven to promote deep

- Cognitive interest cues
- Student goal setting and monitoring
- Vocabulary instruction
- Strategy instruction and modeling
- Visualizations and concrete examples
- High-level questions and student explanations
- Guided initial application with formative feedback
- Peer-assisted consolidation of learning
- Retrieval practice
- Spaced and mixed independent practice
- Targeted support
- Cognitive writing
- Guided investigations
- Structured problem solving

These strategies—all of which are effective and complementary a framework geared toward instructional planning and aligned with ho learns. For each strategy, you’ll find the key research findings principles of classroom practice, and recommended approaches for using the strategy with today’s learners.

Both new and veteran teachers will finish this book with a be understanding of how effective teaching boosts student achiev and a clearer idea of what to do, when to do it, and why.
Acknowledgments

Introduction: Professionalizing Education

1. Helping Students Become Interested in Learning

2. Helping Students Commit to Learning

3. Helping Students Focus on New Learning

4. Helping Students Make Sense of Learning

5. Encouraging Students to Practice and Reflect

6. Helping Students to Extend and Apply Learning

7. Bringing It All Together

Appendix: Research Studies Supporting

The New Classroom Instruction That Works

References

Index

About the Authors

Bonus online-only content is available at www.ascd.org/citw
Introduction: Professionalizing Education

Is teaching a profession? Most of us assume it is—after all, as educators, we spend countless hours in professional learning, and many of us accrue degrees and credentials to demonstrate our professional bona fides. But what exactly does it mean to be a professional? And can educators make the same claim to being members of a profession as, say, doctors, engineers, and lawyers?

We believe they can—and should.

After all, the heart of any profession is shared, precise knowledge—a common understanding of such things as human anatomy in medicine, the principles of building design in engineering, or prior case law and legal principles in jurisprudence. As we’ll share in this book, teaching can (and should) be grounded in a robust body of scientific knowledge. In short, much like how doctors can diagnose a patient’s illness and offer a prognosis, educators can draw upon science to discern student learning needs and use effective solutions to meet those needs.

The good news is these teaching solutions are neither secret nor beyond the reach of educators; you most likely already use many of them. However, educators often lack a shared understanding of evidence-based principles of effective teaching. The field resembles what Harvard researchers have described as “an occupation trying to be a profession without a practice” (City et al., 2009). That is, although research should inform classroom practice, teachers seldom have a shared understanding of this research, a common vocabulary for applying it, or a culture of working together to apply evidence to guide practice.

In contrast, other professions have well-developed professional understandings and vocabularies that allow, for example, doctors to work together to diagnose what may be ailing a patient or a large team of engineers to share design plans as they work to build a bridge. Although the science of teaching is somewhat newer than that of medicine or engineering, it is nonetheless a
robust field—one that ought to establish teaching as not simply an art or trade-craft but a true profession. The core purpose of this book is to help teaching become a profession with a practice by moving beyond fads and unsubstantiated theories and drawing instead upon cognitive science and experimental studies.

Is a New Review of Research Really Needed?

This effort to synthesize recent research on teaching is the latest in a series of research projects at McREL International that started more than two decades ago, when a McREL team synthesized the best available research on instruction into a meta-analysis of research (Marzano, 1998). That analysis served as the basis for the book Classroom Instruction That Works (Marzano et al., 2001), which arguably transformed the landscape of education. Over the next decade, educators worldwide purchased more than a million copies of the book, and it was translated into more than a dozen languages. In the early 2010s, McREL embarked upon a two-year effort to update the meta-analysis (Beesley & Apthorp, 2010), resulting in a second edition of Classroom Instruction That Works (Dean et al., 2012).

Now, 20 years after the initial meta-analysis research and a decade after the second study and edition of the book, we believe it’s time for another update. Over the past two decades, education research has evolved significantly, creating a growing collection of studies that employ scientific methods to measure, with far greater precision than ever before, the true impact of various teaching and learning strategies on student outcomes.

New Insights from a New Generation of Empirical Research

This new wave of research was prompted by a bipartisan federal push in the United States (and elsewhere in the world) for “gold standard” research in education, which helped to create a new science of teaching and learning. Although these newer studies reflect and reinforce much of what we found in our two previous studies, they also provide many new, compelling, and even surprising insights about what works in the classroom.

In simple terms, what most distinguishes this new generation of research studies is that they employ scientifically based research designs. This starts with randomly assigning students to (1) a treatment or experiment group that receives a particular intervention (e.g., a teaching or learning strategy) or
(2) a comparison or control group that typically receives business-as-usual instruction. Employing scientific design helps researchers ensure that findings are not simply the result of confounding variables such as students’ level of poverty, prior knowledge, and ability—or teacher competence. This makes it easier to make causal claims (i.e., \( X \) causes \( Y \)) so that educators can be more certain of the effect of various teaching strategies on students.

Some Shortcomings of Earlier Research

Previous versions of *Classroom Instruction That Works* relied on best-available research, which at the time included studies that accomplished two very important tasks. First, these studies isolated a particular teaching strategy and, second, they quantified that strategy’s effect on student outcomes. Although these studies were far more compelling than theoretical articles with at best anecdotal or qualitative evidence, many of them still did not reflect true scientific research. In fact, only about half—51 of 99—of the studies we examined for the second edition of the book could be classified as scientifically designed studies (Beesley & A Thorp, 2010).

As an example, in many of these studies, teachers and students were not randomly assigned to a treatment or control group. A group of students was chosen to receive a particular teaching approach, and researchers would then compare the performance of students in this group before and after the intervention with the performance of students in the general population. Such methodology can allow hidden factors to skew the findings. For example, if students receiving an intervention are already high performers poised for rapid growth in learning, the strategy might seem more effective than it is. Conversely, if students in the treatment group are hindered by more barriers to success than those in the general population, the strategy might seem less effective than it really is.

Many studies included in the original meta-analysis were also correlational. For example, they examined whether the amount of homework students reported doing each week was linked to their class grades (not surprisingly, it was). Yet correlation does not prove causation. Doing more homework may lead to better grades, but other factors could be at work. Students who report doing more homework might be more conscientious, more motivated, or more attentive in class. Or perhaps their parents are more likely to bug them about doing their homework or pressure them to get good grades. Increased hours of homework might simply reflect a press for achievement or motivation (however reluctant) among students to do their homework, get good grades, and
keep their parents off their backs. In short, we cannot safely conclude from this correlation, however strong it might be, that teachers ought to pile more homework on students.

Building on an Important Contribution to the Field

We understood all of this, of course, when we conducted our original meta-analyses. In fact, that’s one of the main reasons we conducted a meta-analysis in the first place: we wanted to overcome the pitfalls of small sample sizes and potential confounding factors in previous studies. A meta-analysis essentially combines many smaller studies into a larger sample—much like media outlets do when they create “polls of polls” that merge smaller polls into larger polls in order to more accurately capture public sentiment with a smaller margin of error.

Similarly, in education research, combining several smaller studies (from which, individually, it might be difficult to draw strong conclusions) into a large sample lets researchers more confidently assert that certain teaching strategies support student learning. This is what made Classroom Instruction That Works so important and powerful: for many educators, it was the first time they had access to research-based, high-leverage strategies compiled into a single, easy-to-comprehend collection of teaching practices.

That said, meta-analyses have shortcomings. If not carefully constructed, they can, in effect, mix apples and oranges—force-fitting multiple studies into a single measure even though the studies may have examined several or slightly different approaches or strategies, such as different types of feedback (e.g., correct answers or formative) or blended strategies (e.g., pairing cooperative learning with problem-based learning). Meta-analyses may also obscure important subtleties. For example, some studies of feedback found negative effects on student learning, yet those negative effects vanished when examined in combination with other studies reporting positive effects. Nonetheless, we might want to know why these differences emerged. Do certain types of feedback have less benefit for learning? Can feedback be less or more helpful in certain situations?
A New Approach for a New Generation of Research

With all this in mind, we took a different approach in developing the research base for this third edition—which we believe is sufficiently different to warrant the word “new” in the title. For starters, we applied review criteria from the Institute of Education Sciences’ What Works Clearinghouse (WWC) to ensure the studies in our research base employed true scientific research designs and were peer-reviewed. Through this process, we identified 105 classroom-based studies that used scientific designs with sufficient sample sizes to offer valid causal claims about the effectiveness of the teaching strategies in question.

Moreover, in keeping with the idea that true scientific findings should be replicable across multiple studies, *The New Classroom Instruction That Works* highlights only strategies that have been found to be effective in seven or more studies. Typically, these strategies were examined across multiple grade levels, subject areas, and student populations, which suggests they are generalizable across all classrooms.

Also, this time we have chosen not to merge the quantitative results from these studies into a single effect size via a meta-analysis. As noted earlier, doing so can cloud important nuances in study findings and reflect a kind of psychometric sausage-making—pressing disparate studies together into something that, although more consumable, obfuscates important caveats, shortcomings, and insights from the original studies.

Instead of presenting a single effect size, we report how many studies support a particular strategy and list each of these studies with their respective effect sizes, using the WWC-prescribed measure of “improvement index” (see https://ies.ed.gov/ncee/wwc/glossary). This score provides the number of additional percentile points an average student (i.e., one at the 50th percentile) would gain after receiving the treatment intervention. For example, an improvement index score of 10 means that an average student in the treatment group would improve from the 50th to the 60th percentile after receiving the intervention (whereas an average student in the control group would remain at the 50th percentile).
That said, we remind readers that an effect size is simply an *estimate* of the impact of a particular strategy or set of strategies, not a guarantee. Studies of similar strategies, in fact, rarely report the same effect size (which illustrates the fact they are all estimates in the first place). When discrepancies in effect sizes arise in the rigorous studies we examined, we offer some explanation for why such differences might be present so that you, as a professional educator, can make your own judgments about how and when to use the practice in question with students.

Perhaps most important, our current review of research did not start with the foregone conclusion that the nine categories of effective teaching practices highlighted in previous editions of this text represented the final word on effective teaching strategies. Rather, like true scientists, we started from scratch, taking a fresh look at what a new generation of research tells us about effective teaching and which practices all teachers should build into their professional repertoire.

### Focusing on Diversity, Equity, and Inclusion

Perhaps most important, in building the research base for this book, we intentionally searched for studies of interventions delivered to historically disadvantaged student groups, including students of color, students in poverty, emergent bilingual students, and those with low prior levels of achievement. As it turns out, a great deal of experimental research over the past two decades has explicitly focused on identifying effective interventions for these students. As a result, most of the 105 studies in our research base (see the Appendix) were conducted with diverse student populations. Specifically, we note the following:

- Fifty-five (52 percent) were conducted in classrooms where 40 percent or more of the population were students of color (African American, Hispanic, or Indigenous groups).
- Forty-five (43 percent) were conducted in classrooms where 40 percent or more of students qualified for free or reduced-price lunch.
- Thirty-four (32 percent) were conducted with students with an identified learning disability or identified as being at risk of academic failure due to low prior achievement.
- Twenty (19 percent) were conducted in classrooms where 25 percent or more of the student population were identified as emergent bilingual students.
The remainder of the studies included in our sample (30 studies—or 29 percent), were conducted in classrooms where the majority of students either did not reflect these student groups or demographic data were not reported. What this means is, instead of starting with research on general student populations and attempting to extrapolate findings to diverse learners, the research base for *The New Classroom Instruction That Works* starts with diverse learners and, thus, identifies teaching strategies proven to work for diverse learners. It’s not surprising, then, that many of the strategies in this edition reflect what others have identified as “culturally relevant practices”—including making learning relevant to students, engaging them in critical thinking and reflection about their learning, and helping them to develop a positive view of themselves as learners through goal setting and peer-assisted learning. Perhaps most significantly, many of the teaching practices highlighted in this book were found to close learning gaps between historically marginalized student groups and their peers. Thus, the strategies highlighted here can help to define, in a scientific way, teaching practices that support more equitable outcomes for all learners.

**New Guidance from New Research**

As might be expected, our new methodology yielded a different set of high-leverage teaching strategies. Although many mirror those from previous editions, they differ in some important ways.

**A smaller set of strategies**

Most notably, we have identified a smaller set of strategies—winnowing down 48 strategies grouped under nine categories in the second edition of *Classroom Instruction That Works* to the 14 strategies in this book. This does not mean the strategies highlighted in previous editions don’t work; it just means that in our new analysis, we were unable to find scientifically designed studies to support them. Nonetheless, as the saying goes, absence of evidence is not evidence of absence. In some cases, strategies identified through less scientific means (e.g., surveys or correlational studies) may still be valid. So, we do not advocate for teachers to abandon strategies highlighted in previous editions that have fallen off this list, especially if they find them beneficial. Rather, we would say this: the strategies highlighted in *The New Classroom Instruction That Works* have been shown, scientifically, to support better learning for diverse students.
Thus, we can unequivocally assert that teachers ought to master and include these strategies in their professional practice.

**Practical guidance for each strategy**

A strategy is only meaningful if teachers can readily apply it in their classrooms. Although this book is grounded in research, our intent is not to offer exacting details of each study but rather to “cut to the chase,” so to speak, with practical guidance you can apply in your classroom. If you wish to dive more deeply into the research supporting each strategy, we provide tabular summaries in the Appendix and offer more detailed summaries of each study in a free online resource available at [www.ascd.org/citw](http://www.ascd.org/citw).

We also recognize that what’s most important with any evidence-based teaching strategy is how well teachers adapt it to the unique needs of their own learners. So, for each strategy, we highlight guiding principles that emerge from research and offer classroom tips for how you might apply these principles—not to prescribe one-size-fits-all approaches but to help you apply your own professional judgment in using these strategies to meet the unique needs of every learner in your classroom.

**Links to the science of learning**

We’ve linked these strategies with what is known about the science of learning as reported in our book, *Learning That Sticks* (Goodwin et al., 2020). In the two decades we’ve spent helping teachers apply the strategies in *Classroom Instruction That Works*, we have consistently found that the real inflection point in any teacher’s professional growth (i.e., when they become true professionals) is when they become intentional in their use of evidence-based strategies (i.e., knowing not only what works but also when and why it works). Because the science of learning reflects how every human brain works regardless of cultural context or background, it offers insights that are valid for all students. Thus, we’ve aligned these strategies with the six phases of learning described in *Learning That Sticks* to illustrate how teachers can use them to, for example, help students “focus on new learning” or “make sense of learning.”

**The New Toolkit of Strategies**

Our comprehensive review and analysis of scientific studies yielded 14 teaching strategies with significant positive effects for a diverse array of students.
Figure I.1 maps these strategies to the six phases of learning identified in *Learning That Sticks* (Goodwin et al., 2020).

<table>
<thead>
<tr>
<th>LEARNING PHASE</th>
<th>TEACHING STRATEGIES</th>
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<tbody>
<tr>
<td><strong>Become interested.</strong></td>
<td>To engage in learning, students must first become interested in and find content worthy of attention.</td>
</tr>
<tr>
<td>Strategy 1: Cognitive interest cues</td>
<td></td>
</tr>
<tr>
<td><strong>Commit to learning.</strong></td>
<td>Because all learning requires sustained mental effort, students must commit to their learning.</td>
</tr>
<tr>
<td>Strategy 2: Student goal setting and monitoring</td>
<td></td>
</tr>
<tr>
<td><strong>Focus on new learning.</strong></td>
<td>Once students are interested in and committed to learning, they must encounter it in ways that help them to master new knowledge and skills.</td>
</tr>
<tr>
<td>Strategy 3: Vocabulary instruction</td>
<td>Strategy 4: Strategy instruction and modeling</td>
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<tr>
<td>Strategy 5: Visualizations and concrete examples</td>
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<tr>
<td><strong>Make sense of learning.</strong></td>
<td>All learning consists of connecting new knowledge with prior knowledge, aggregating ideas into manageable constructs or mental models, and integrating discrete skills into larger sequences that can be used to solve problems and accomplish tasks.</td>
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<tr>
<td>Strategy 6: High-level questions and student explanations</td>
<td>Strategy 7: Guided initial application with formative feedback</td>
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<td>Strategy 8: Peer-assisted consolidation of learning</td>
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<tr>
<td><strong>Practice and reflect.</strong></td>
<td>Once students have encountered and made sense of learning, they must retrieve and repeat it multiple times to store it in long-term memory.</td>
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<tr>
<td>Strategy 9: Retrieval practice (quizzing to remember)</td>
<td>Strategy 10: Spaced, mixed independent practice</td>
</tr>
<tr>
<td>Strategy 11: Targeted support (scaffolded practice)</td>
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<tr>
<td><strong>Extend and apply.</strong></td>
<td>For students to store and retrieve new learning, they must engage with it in multiple ways—applying it to solve real-life, complex problems or extending it in novel ways.</td>
</tr>
<tr>
<td>Strategy 12: Cognitive writing</td>
<td>Strategy 13: Guided investigations</td>
</tr>
<tr>
<td>Strategy 14: Structured problem solving</td>
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practical tips for applying it in your classroom. The final chapter includes suggestions for working with your colleagues to embed these strategies into your own professional practice to ensure teaching becomes a profession with a practice in your school so that, together, you can support the success of every learner.
Helping Students Become Interested in Learning

At the risk of stating the obvious, to learn anything, one must pay attention to it—that is, become interested in it. As simple as that sounds, our brains are really good at ignoring what’s going on around us. That’s because, while our senses absorb an estimated 11 million bits of information per second, our brains can process only about 120 bits of that per second (Levitin, 2015). To avoid information overload, our brains disregard most of the stimuli in our environment and pay attention only to what we deem the most important bits of information.

The ramifications for teaching are considerable. Students’ brains are designed to ignore most of what is going on in the classroom. It’s on teachers, then, to use tried-and-true techniques—what we call cognitive interest cues—to help learning get past students’ mental filters and into their brains. In this chapter, we’ll share key findings and practical strategies from scientific studies that demonstrate the power of stimulating student interest as a critical precondition for learning.

What the Research Says

First, we’ll explore why it’s so important that students become interested in learning in the first place and what happens to student interest once they enter school. We’ll also share an “open secret” to stimulating student interest that, sadly, remains untapped in many classrooms and schools.
Student engagement is as strongly correlated to student success as teacher quality

Here’s the first big idea from research: *student interest and motivation matters.* Research shows that academic success is the result of many factors, including school and teacher quality, parental press for achievement, prior learning, and student interest and motivation. As it turns out, student interest and motivation have as much influence on academic success as teaching quality, long touted as the most important within-school factor linked to student success. Interest and motivation accounts for approximately 14 percent of the variance in student outcomes; teacher quality contributes to roughly 13 percent of the variance in their outcomes (Marzano, 2001).

In the real world, of course, student interest and motivation and teacher effectiveness are often intertwined; great teachers can and do spark student interest and motivation. Indeed, empirical research demonstrates that when teachers focus on sparking student interest, they can have significant positive effects on student motivation—and, in turn, on learning outcomes. This is particularly good news given that the same analysis of factors linked to student success (Marzano, 2001) found that student socioeconomic status accounts for 10 percent of the variance in their overall performance. In other words, a combination of motivated students and effective teachers can more than offset the barriers of socioeconomic status.

Student effort compensates for ability

A key reason interest and motivation are so strongly linked to student success is that motivation tends to translate into effort. Education research, in fact, confirms the old adage that “hard work beats talent when talent doesn’t work hard.” Using amount of time spent on homework as a proxy for effort, Keith (1982), for example, found that with just one to three hours of homework per week, so-called low-ability students (those at the 25th percentile on standardized aptitude tests) achieved grades commensurate with average-ability students (those at the 50th percentile) who spent no time on homework. Similarly, average-ability students who do two to three hours more homework per week than high-ability students (those at the 75th percentile or above) earn the same grades as high-ability students. In short, student ability is not a fixed trait; just 25 minutes per day of extra effort can lift students to higher levels of performance. Student effort matters a lot.
Students demonstrate less curiosity and engagement the longer they stay in school

Although student interest and motivation can contribute significantly to their performance, with each passing year in school, students become less motivated and engaged. A Gallup poll of 500,000 students from 5th to 12th grade, for example, found that while most (8 in 10) elementary students feel “engaged” in school—that is, attentive, curious, and optimistic about their learning—by high school, that number is halved (Busteed, 2013).

Certainly, teenagers expressing boredom and apathy is neither a new phenomenon nor a seismic shift in generational attitudes (who among us didn’t complain of boredom while in school?). Nonetheless, we must ask ourselves why this happens. Why do so many middle and high school students complain of boredom when secondary school ought to be the very time they explore the mysteries of science, the complex drama of human history, the elegant language of math, and works of literature that reveal our shared humanity? Fortunately, student boredom need not be a fait accompli. Multiple studies point to practical ways teachers can spark student curiosity, interest, and motivation.

Internal rewards are more powerful motivators of deep learning than external rewards

Decades of psychology research suggests there are basically two ways to motivate students: (1) external rewards (e.g., using grades, gold stars, or stickers to bribe and cajole students into learning) and (2) internal rewards (e.g., helping them to find inherent interest and meaning in mastering new knowledge and skills). External rewards, sometimes referred to as “carrots and sticks,” are commonplace in schools. Yet as Alfie Kohn (1999) observed, the net effect of using external rewards to motivate students is that, over time, students begin to see learning not as something they want to do but as a chore they have to do: something to be endured if they want candy, playground privileges, or a decent grade point average (GPA). For example, when researchers rewarded young children with cookies for drawing pictures (something they were doing for enjoyment prior to the study), those students became less likely to entertain themselves afterward by drawing pictures, presumably because the external rewards turned an erstwhile fun activity into something done to please others (Deci et al., 1999).

Teachers who rely on external rewards may send the wrong message: that learning is a trial to be endured rather that an opportunity to be relished and enjoyed. Moreover, 40 years of research show that extrinsic rewards only
motivate performance on simpler tasks, whereas intrinsic rewards motivate performance on more complex tasks (Cerasoli et al., 2014). Some forms of learning, such as memorizing basic skills and facts, are simple and inherently less enjoyable for students. It’s just good sense for teachers to occasionally use external rewards to motivate students to complete simple learning tasks, such as rewarding them with small prizes for beating their previous high score on multiplication tables. But if the goal is for students to engage in more complex learning—for example, to use basic math facts to solve complex, real-world problems—teachers need to help students identify the intrinsic rewards in learning by, for example, tapping into curiosity, personal experience, and interests. In Chapter 2 we’ll explore different ways to encourage students to commit to learning.

Curiosity primes the brain for learning and supports retention of learning

Brain research shows that sparking curiosity not only makes learning more rewarding but also supports better retention of learning (Gruber et al., 2014). This, after all, is our true aim as educators: to ensure students both learn and remember the content they encounter in our classrooms. Basically, curiosity makes their brains thirsty for new learning and, thus, better able to retain learning. What this all adds up to is that student interest and motivation are essential to student success. Yet, as noted, the longer students stay in school, the less interest they experience in school.

Fortunately, empirical studies point to a tried-and-true strategy for motivating students by tapping into their curiosity, interests, and experiences: cognitive interest cues.

Strategy 1: Cognitive Interest Cues

*Cognitive interest cues motivate learning by framing units and lessons in ways that make learning stimulating and relevant to students.*

Experimental studies point to the power of sparking students’ intellectual curiosity and making learning relevant to them, a strategy we call cognitive interest cues. We use the word *cognitive* intentionally here because the key is to get students thinking about what they will learn. Cognitive interest cues aren’t simply gimmicks or classroom razzle-dazzle that grabs kids’ attention but fails to prime their brains for learning. Rather, they are proven methods for helping students to
become intellectually engaged and intrinsically motivated to learn. Collectively, these studies offer convincing evidence that teachers can (1) stimulate students' interest in learning and (2) in so doing, enhance student achievement.

We identified 14 studies with significant effects for which cognitive interest cues were a core element of the intervention (see the Appendix). These interventions had improvement index scores ranging from 8 to 49—which translates into raising the achievement of an average student (i.e., at the 50th percentile) from 8 to 49 percentile points. These studies have been conducted across multiple subject areas and grade levels, and with a diverse array of student populations. It’s important to note that interest cues are seldom stand-alone strategies; more often, they are key elements of larger interventions, which suggests that this strategy should be integrated with other proven strategies.

Guiding principles for cognitive interest cues

The following guiding principles for cognitive interest cues emerge from these 14 studies.

*Effective cognitive interest cues relate directly to desired learning outcomes.*

You’re likely familiar with presenters who open their remarks with a pithy anecdote or witty joke that might grab listeners’ attention but has little connection to the topic at hand. Afterward, you might be able to recall the presenter’s joke or anecdote . . . but not the actual content of their remarks. Teachers can make the same mistake in their classrooms. In an effort to grab students’ attention, they share a funny video, tell an amusing anecdote, or make a reference to popular culture that has little to do with the learning at hand and may only serve to confuse students. So, it’s important to note that, across all of the effective interventions studied, cognitive interest cues were carefully designed to draw students into the content at hand, anchoring their learning to curiosity-provoking questions or meaningful challenges.

For example, two studies (Bottge et al., 2014, 2015) found positive effects for “enhanced anchored instruction”—introducing students with learning difficulties to complex math problems with introductory videos designed to make problems interesting and relevant. One such video depicted three friends attempting to build a skateboard ramp on a budget, which required them to make measurements, convert feet to inches, calculate sales taxes, and solve other problems. Similarly, Vaughn and colleagues (2017) found positive effects for an intervention that included a “comprehension canopy” to frame social studies for 8th grade students in schools with high percentages of
emergent bilingual students and students in poverty. At the start of each lesson, teachers engaged students in a 10- to 15-minute routine that included an engaging video clip framing the purpose for the upcoming lesson, linking new learning to prior knowledge, and cueing the thinking strategies students would need to apply during the lesson (e.g., comparison and contrast, cause and effect, perspective taking).

**Hands-on learning experiences increase student interest.**

Across multiple studies, cognitive interest cues engaged students in hands-on learning experiences designed to spark their curiosity and interest by translating abstract concepts into concrete puzzles, challenges, and problems to solve. For example, Guthrie and colleagues (2004) studied the effects of teaching science to a racially diverse group of 3rd graders with a combination of cognitive strategies (e.g., activating background knowledge, high-level questioning, graphic organizers, direct instruction of text structure) and motivational practices such as engaging students in hands-on learning experiences (e.g., dissecting owl pellets) and providing them with interesting texts to read related to their hands-on learning. Compared with a group receiving cognitive strategies alone and a control group receiving traditional instruction, the students who received both cognitive and motivational strategies significantly outperformed those receiving cognitive strategies alone (improvement index = 26) and those receiving traditional instruction alone (improvement index = 46).

**Making personal connections to learning increases motivation and performance.**

Experimental studies have also found that helping students draw personal connections to learning increases both their motivation and achievement. For example, Hulleman and colleagues (2010) found that college students who wrote short essays connecting what they were learning in a psychology course to their personal lives not only demonstrated greater interest in the course but also earned higher grades. Effects were even greater for students demonstrating low interest and achievement during the first half of the course.

Anand and Ross (1987) similarly demonstrated the benefits of helping racially diverse (52 percent African American) groups of students make personal connections to their learning, comparing the effects of engaging 5th and 6th grade students in three different versions of a computer-assisted lesson on division of fractions. In the first condition, personal information about the students (e.g., their friends, interests, hobbies) was incorporated into math problems. In the second condition, problems were presented with concrete (realistic but still
hypothetical) contexts. In the third condition, problems were presented in a traditional abstract format. Afterward, students who received personalized problems not only reported greater interest in learning but also demonstrated higher performance on post-tests than students receiving problems with concrete representations only (improvement index = 31) and traditional problems with abstract representations (improvement index = 44).

Along similar lines, Cordova and Lepper (1996) found that students who engaged in a gamified version of math learning (i.e., solving math problems to “navigate a spaceship”) with personal information (e.g., their own names, names of friends, favorite foods) embedded into the game demonstrated not only greater interest in learning but also better learning outcomes than students who engaged in a similar math game without the fantasy frame (improvement index = 49) or played the spaceship fantasy game without personal details included (improvement index = 37). In another study, a key component of an intervention for elementary school students with significant positive effects in improving student learning in social studies (improvement index = 49) and science (improvement index = 48) included a full day of concept lessons designed to cue cognitive interest by connecting academic concepts to racially diverse, low-income students’ own lives (Dombek et al., 2017). Collectively, these studies demonstrate the power of helping students make personal connections to their learning.

**Cognitively challenging learning increases student interest.**

Multiple studies have demonstrated that low-achieving students don’t need less rigorous or challenging lessons or texts. They actually benefit from the opposite—learning experiences that engage them in cognitively complex ideas and expose them to accessible yet thought-provoking texts. For example, in a large-scale study (Stevens, 2003) involving nearly 4,000 students in urban, high-poverty middle schools, the intervention was designed to engage students with high-interest, cognitively challenging texts from well-known authors (e.g., Langston Hughes, Pearl S. Buck, Isaac Asimov) and frequent, challenging writing exercises (e.g., “Write a short story in the style of O. Henry”). Students in the treatment group significantly outperformed those in the business-as-usual control group on measures of reading vocabulary (improvement index = 13), reading comprehension (improvement index = 10), and language expression (improvement index = 15).

Similarly, Kim and colleagues (2017) found positive effects for a yearlong approach to improving reading outcomes for a racially diverse (50 percent nonwhite)
group of middle school students with a history of low levels of reading achievement (scoring at or below the 30th percentile) in schools with moderate to high levels of poverty (49–90 percent free and reduced-price lunch recipients). Students in the treatment group engaged in reading cognitively complex, personally relevant, and accessible fiction and nonfiction. In short, rather than simplifying or “dumbing down” learning in a misguided effort to make it more accessible, the intervention aimed to motivate students and cue cognitive interest by exposing them to readable texts that challenged their thinking and sparked their curiosity. Students who received the intervention demonstrated not only increased engagement in reading (improvement index = 31) but also statistically significant improvements in reading comprehension (improvement index = 8).

Classroom tips for cueing cognitive interest

Such studies demonstrate the power of stimulating student interest and curiosity by exposing students to cognitively challenging concepts and ideas, engaging them in hands-on and relevant learning, and helping them draw personal connections to their learning. Failing to stimulate student interest in learning is, in effect, asking them to overcome their own brains’ natural mental filters in order to pay attention to what’s happening in the classroom. On the other hand, stimulating students’ interest in learning can make the entire process of learning more productive and joyful. Here are a few practical tips for translating this research into action in your classroom.

Activate prior learning to create a knowledge gap.

Activating prior knowledge is a powerful way to stimulate student interest (Guthrie et al., 2004; Vaughn et al., 2017). Curiosity itself is simply the recognition of a gap in knowledge, which requires a “reference point” (Loewenstein, 1994, p. 87). Students must know something about a topic before they can become interested in it. For example, you might be more apt to be curious about dog training if you’ve recently adopted a puppy.

In the classroom, it’s important to help students connect new learning to prior knowledge by helping them see a critical gap in their knowledge; this creates a mental “itch” they want to scratch. Here’s a straightforward template you can use as you begin to activate students’ prior knowledge to stimulate their interest in new learning: “You know _____, but did/do you know ____?” For example:
• You know how to calculate the area of shapes with straight sides, but did you know there’s a “magic” formula you can use to calculate the area of a circle?
• You know about the ruins of an ancient civilization in the jungles of Central America, but do you know how this once mighty civilization disappeared?
• You know that people often make “slippery slope” arguments that predict that small actions will lead to disaster, but did you know such claims are actually logical fallacies?

Questions are, of course, the heart of curiosity. As you plan a unit or lesson, consider first what prior learning students bring and second what new learning they will encounter. Doing so will help you to frame learning as a series of questions that help students activate their prior learning and connect it with what’s coming next. See Figure 1.1 for some examples, organized by content area.

**FIGURE 1.1 QUESTIONS THAT USE PRIOR LEARNING TO CUE COGNITIVE INTEREST**

<table>
<thead>
<tr>
<th>LANGUAGE ARTS</th>
<th>MATH</th>
<th>SCIENCE</th>
<th>SOCIAL SCIENCE</th>
<th>ARTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>You’re all familiar with verbs. But did you know some verbs are weak and others are strong . . . and that good writers use strong verbs to “power up” their sentences?</td>
<td>You’ve likely heard mathematical predictions—for example, that a sports team has a 60 percent chance to win a game. But what does this really mean?</td>
<td>Based on what you’ve learned about the five animal groups, which do you think are best adapted to cold climates?</td>
<td>You’ve all used money to buy goods. But have you ever wondered how money works? Why do we accept a piece of paper in exchange for goods and services?</td>
<td>What did we learn from our color mixing that can help us create a one-color mosaic of different shades?</td>
</tr>
<tr>
<td>Have you ever finished reading something and realized you didn’t absorb much of it? How can we read closely so this doesn’t happen?</td>
<td>We’ve used linear equations to depict consistent proportional relationships. But what if relationships aren’t consistently proportional?</td>
<td>You’ve all seen living things grow. What do you think may be going on deep inside them to make them grow?</td>
<td>Have you heard people criticize the president and other elected leaders? Did you know that in many nations such criticism is illegal? How did we get this right?</td>
<td>We’ve learned about the “rules” of minor chords and scales. What would it sound like if we “broke” those rules with additional chromatic notes called “blue notes”?</td>
</tr>
</tbody>
</table>

continued
FIGURE 1.1 QUESTIONS THAT USE PRIOR LEARNING TO CUE COGNITIVE INTEREST (continued)

<table>
<thead>
<tr>
<th>LANGUAGE ARTS</th>
<th>MATH</th>
<th>SCIENCE</th>
<th>SOCIAL SCIENCE</th>
<th>ARTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you noticed how people can view the same event quite differently? During this unit, we’ll learn to appreciate how writers’ different cultures and experiences influence their views.</td>
<td>How can we use what we’ve learned about mathematical modeling to predict the amount of water needed to support population growth in arid areas, like the Western United States?</td>
<td>If you’ve been near a beach in the summer, you’ve likely experienced daytime sea breezes and nighttime land breezes. What scientific principles might explain these phenomena?</td>
<td>We’ve seen how Rome struggled to maintain an empire spread across vast bodies of water and land and distinctly different cultures. What might be different for an empire, such as the Chinese, as they spread into more geographically and culturally cohesive regions?</td>
<td>Based upon what you’ve learned about modern dance in the United States, in what ways does it reflect the unique culture, heritage, and peoples of this country?</td>
</tr>
</tbody>
</table>

Use curiosity hooks.

Many of the effective interventions highlighted in this chapter began with teachers posing questions to hook student curiosity. There are some tried-and-true curiosity hooks that have emerged from research.

**Mysteries.** Robert Cialdini (2005), a psychologist at Arizona State University, wrote an article called “What’s the Secret Device for Engaging Student Interest? The Answer Is in the Title.” In it, he shared his epiphany after poring over dozens of science articles trying to figure out how to make complex content interesting for students. The best science writers, Cialdini noted, eschew the typical, yawn-inducing opener, “In this article, I will present arguments in favor of my theory of XYZ.” Instead, they pose questions—questions like “What are the rings of Saturn made of—rock or ice?” Then they build suspense about their topic—arguments in favor of rock and of ice—before resolving the mystery. (The answer in this case is the rings of Saturn are made of both rock and ice.) You can take a similar approach in your classroom by presenting learning as a mystery. “What caused the wooly mammoth to go extinct?” “How could the vastly outnumbered American Colonial Army have defeated the British Empire?” “How do scientists measure the distance to faraway planets?” “What did people use before clocks were invented?”
Controversy. Research also shows that controversy begets curiosity (Loewenstein, 1994). In a now famous experiment, Lowry and Johnson (1981) randomly assigned 5th and 6th graders to work in groups. One group was instructed to come to a consensus about a particular topic (e.g., strip mining or designating wolves as endangered species); the other was encouraged to develop their own arguments regarding the topic. Students in the second group demonstrated more interest in the topic, sought more information on it, and were more likely to give up a recess period to watch a film about it.

Yes, some controversies may be too touchy to broach in classrooms (they might even be officially “off limits”), but many are not. Here are some examples:

- Are we victims of fate like the “star-crossed lovers” Romeo and Juliet, or do we have control over our circumstances?
- One way to reduce greenhouse gases would be to build nuclear power plants; after exploring the pros and cons of this energy source, what do you think?
- Is there another way to calculate the area of this irregular shape? Which is better and why?
- “Social media does young people more harm than good.” How would you respond to this statement, using facts and logic to support your argument?

Riddles and suspense. Incomplete sequences (e.g., 1, 2, 3, 5, 8 . . . what comes next?), unfinished narratives (e.g., a cliff-hanger prior to a commercial break), and unsolved puzzles (e.g., 5 + x = 8; 12 – x = 9, what’s x?) create suspense. Here are some examples of ways to create suspense in your classroom.

- We’ve seen that Ralph and Jack have very different personalities. They’re both leaders, yet tension is brewing between them. What do you think will happen now that the boys are alone on the island?
- We know that mixing baking soda and vinegar together creates carbon dioxide. What will happen when we pour this mixture into a jar with a lit candle?
- We’ve seen complex alliances formed across Europe in the early 20th century. What might happen if a leader of one of these nations were assassinated?
- At what point does a square become a rectangle?

Cognitive conflict. Students also experience curiosity when they encounter something that conflicts with their prior learning or conceptions—for example, when they learn that winds blowing down from chilly mountaintops make the valleys below warmer, not colder, or that offering supermarket shoppers multiple flavors of jam makes them less likely to purchase a jar than when they
were offered only a few choices. Cognitive conflict leaves students wondering, “Why is that?”

Students’ common misconceptions are often a good way to create cognitive conflict. Here are some examples:

- When players make several shots in a row in a basketball game, do they really have a “hot hand” (like many people think), or does that streak of successful shots just reflect random, mathematical probability?
- A lot of students think the best way to study is to reread a chapter many times. As it turns out, that’s not true. Today, we’ll learn a better strategy.
- When a smaller nation encounters a larger one in a military conflict, does the larger nation always prevail? Not always!
- Which is cooler, the metal part of your chair or the fabric part? As it turns out, they’re both the same temperature. The metal part of your chair feels cooler to the touch because of something we’ll learn about today called “heat transfer.”
- When you divide by a fraction, why do the numbers get larger?
- When you multiply a whole number by a decimal, the product is smaller than the original whole number. What happens when you divide using decimals?

A Hollywood axiom holds that a film that fails to hook audiences within the first 10 minutes is likely to bomb in theaters. The same might be said of classroom lessons and units. Like movie audiences, students bring varied interests, needs, motivations, and cultural lenses to the classroom. Some like mysteries, and others like solving problems and puzzles. Some students are motivated to help others, and some want to roll up their sleeves and engage in hands-on work. No single strategy is likely to fire every student’s imagination, spark their curiosity, or make learning relevant to them. So, like a good movie, it’s best to provide multiple “hooks” to draw students into learning. You can plan units and lessons to identify multiple ways to draw every student into learning (see the process outlined in Figure 1.2).

**Help students make relevant connections to new learning.**

Studies of both high school (Hulleman & Harackiewicz, 2009) and college students (Hulleman et al., 2010) have demonstrated that encouraging students to make personal and practical connections to new content improves both motivation and learning. Older students often can make connections with, for example, writing prompts that ask them to relate what they’re learning to their own lives. Younger students may need additional support in making such
connections. A good way to begin is by showing them how to use what they are learning in the real world. Here are some examples:

- Adding, subtracting, multiplying, and dividing fractions is something we often must do. For example, if your recipe makes four servings but you need to bake for six, what do you do when the recipe says to use 1½ cups of milk and 2¼ cups of flour?
- Have you ever seen something interesting and wanted to describe it to others? We are going to learn how writers and poets use words to paint pictures in other people’s minds.
I’m sure you hate feeling sick. During this unit we’re going to learn what makes us sick and what’s happening in our bodies when we’re sick so that we can help our bodies fight the battle that rages inside them when we’re sick and recover faster.

Did you know most athletes use knowledge of angles to succeed in their sports? We are going to learn about angles and how they help athletes (and us) improve performance.

Politicians are notorious for bending the truth in their speeches. We are going to learn how to identify false claims and replace them with credible facts and details.

During the next few lessons, we will learn about gravity and centrifugal force, two forces that help you balance when you are riding a bike.

Why is it important to be able to tell time on an analog clock? We are going to be able to read the clock at the back of the classroom so you can easily tell for yourself when recess, lunch, and specials are every day.

Get to know your students.

Because students bring different interests, motivations, and cultural lenses to your classroom, identifying hooks to stimulate their interests requires you to think beyond yourself and what you find interesting. Instead, take steps to identify which aspects of the content might resonate with your students. Simple writing prompts at the beginning of a semester or school year can help you learn more about your students’ personal lives and interests:

I often lose track of time when I’m ______________.
One thing I’m curious about right now is ______________.
If I could make one change in the world it would be ______________.
One interesting thing that most people don’t know about me is ______________.
My family has instilled in me the value of ______________.
The person from history I would most like to meet is ___________ because ______________.
I think the most important thing you should know about me as my teacher is ______________.

The more you learn about your students, the more you can empower them to make their own connections to their learning. After all, it’s more important that students find their own interests and reasons for learning than be told what to think or feel about their learning.
Final Thoughts: Disengaged Students … or Disengaging Lessons?

We often hear teachers lament that their students are disengaged, as if disengagement were a personality trait or a character flaw. What the research demonstrates, however, is that student disengagement is a response to classroom conditions. Stated bluntly, students disengage when classrooms are disengaging.

In this chapter, we’ve reviewed some simple, straightforward strategies that you can use to pique student curiosity and hook their interest in learning. Yes, these strategies take some additional time to plan and deliver, but it’s worth it. If your students don’t pay attention to what’s going on in your classroom—if they don’t find it interesting, relevant, or meaningful—you can be assured they will not learn it.

Stimulating student interest is, of course, just the beginning of the learning process. Yet it can supercharge other effective teaching strategies and deliver tangible benefits for low-performing students. In Chapter 2, we’ll explore the next phase of learning—which is, in effect, all about sustaining students’ interest in learning by helping them to take ownership of their learning and steer it toward long-term memory.
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*Note:* Studies included in the synthesis are in **bold type**.


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Index

The letter f following a page number denotes a figure.

ability, effort’s relation to, 12
abstract concepts, comprehending, 57
achievement gaps, 98–99
animations, conceptual understanding and, 56–57
assessment, 99
automated processing, 41–42, 72–73
become interested. See interest in learning
blocked practice, 93
brain, the human
        automated processing, 41–42
        bits of information per second processed, 11
        curiosity and, 14, 27
encoding and consolidation function, 61–63
low-effort mode, overcoming, 14, 18, 27, 30
memory and the, 40–41, 60, 62–63
operating systems, 26–27
timeouts requirement, 64

Classroom Instruction That Works, bridging
to The New Classroom Instruction That
Works, 132, 133–134

Cognitive writing
        empirical studies of, 151f
to ensure deep learning, 120–121
learning phase related to, 9f
purpose of, 111
cognitive writing, classroom tips for
develop tools and guides for structure,
115, 116f
provide opportunities to share and
revise, 116, 117f
start with what you want students to
think about, 113–114, 114f
thinking skills need taught and
modeled, 114–115, 115f
use rubrics for all assignments, 115–116
cognitive writing, guiding principles for
critical-thinking strategies are taught
with exercises, 112
extend and apply prior learning with
exercises, 113
structure opportunities to think about
learning, 112
commit to learning. See also goals
effort-success understanding in, 28–29
goal setting and monitoring strategy,
29–32
research findings, 26–29
teaching strategies related to, 9f
comprehension canopy, 15–16
consolidation of learning. See also peer-
assisted consolidation of learning
encouraging explanations about
thinking supports, 66
guided initial application with
formative feedback strategy, 70–76
reflective questions support, 66–67
controversy, using to cue curiosity, 21
cooperative learning, 133f. See also peer-
assisted consolidation of learning
critical thinking skills, 108–109
cues, 133f. See also cognitive interest cues
curiosity
        the brain and, 14, 27
cognitive interest cues for, 14–18
decreases in, time in school and, 13
curiosity (cont'd)
  retention of learning and, 14
  tips for cueing, 18–24, 19–20f
curiosity hooks, 20–22, 23f

deep learning
  cognitive writing to ensure, 120–121
  hands-on and real-world experiences for, 120
  mental models for, 107
  motivators of, 13–14
  vocabulary for, 42
demonstration
  show and tell with, 54
  step-by-step, 52–53
diversity focus in research, 5–7
drawings, using to visualize problems, 129
education, professionalizing, 1–2
education research
  meta-analysis studies, 3–5
  scientifically based, 2–4
effect sizes, 5–6
  effort. See also goal setting and monitoring
  ability in relation to, 12
  reinforcing, 133f
  success, relation to, 28–29
encoding new learning, 61–63, 118–119
engagement, 12–13, 13, 16
equity focus in research, 5–7
extend and apply learning
  cognitive writing strategy, 111–116
  guided investigations strategy, 117–122
  research findings, 106–111
  structured problem-solving strategy, 123–131
  teaching strategies related to, 9f
fate control, success and, 29
feedback. See also guided initial application
  with formative feedback
  detrimental effects, 64
  formative, specific and actionable, 75, 75f
  formative, to support reflection and thinking, 71–72
  goal effectiveness and, 31
  progress, 72–73, 76
  tailored, 71
  targeted, 74–75
  timely correct-answer, 89, 91
  timing, 63–64
  focus on new learning. See new learning
  forgetting curve, 86
goals
  effective, 30
  mastery, 37, 38f
  mastery versus performance, 28, 31–32
  performance, reframing as mastery, 38f
  in rewarding learning, 27
  specific versus vague, 30–31
  value x expectancy formula for pursuing, 27–28
goal setting and monitoring
  benefits of, 29, 39
  empirical studies of, 141f
  learning phase related to, 9f
goal setting and monitoring, classroom tips for
  ensure specificity, 34–35, 35f
  internalizing the power of, 33–34
  mastery goals, 37, 38f
  monitor progress, 36, 37f
  positive habits of mind, 38–39
  teach explicitly, 33–34
  use first-person stems to personalize objectives as success criteria, 36
  goal setting and monitoring, guiding principles
  growth mindset, importance of, 32
  set mastery goals, 31–32
  set specific goals, 30–31
  use concrete, achievable goals for straightforward tasks, 30
  use feedback, 31
  graphic organizers, using to visualize problems, 129, 130f
  guided initial application with formative feedback
  empirical studies of, 146f
  learning phase related to, 9f
  purpose of, 70
  guided initial application with formative feedback, classroom tips for
  identify error patterns and provide targeted feedback, 74–75
  on mastery shift to progress feedback, 76
  observe during initial application, 74
  use specific and actionable formative feedback, 75, 75f
  use the thrice is nice principle, 76
  guided initial application with formative feedback, guiding principles
  observation with tailored feedback is beneficial, 71
  progress feedback aids automation, 72–73
  reflection and thinking is supported with formative feedback, 71–72
  three correct responses supports mastery, 73
  use front-loading with direct strategy instruction and modeling, 70–71
  guided investigations
  empirical studies of, 152f
  learning phase related to, 9f
  purpose of, 117–118
guided investigations, classroom tips for
ensure return to thinking about
key concepts, big ideas, enduring
understandings, 122
identify what to teach versus what
should be discovered, 121–122
start with what students should think
about and need to see, 121
use the learning model to design
investigation, 122, 122f

guided investigations, guiding principles
balance self-direction with teacher-
guided learning, 119–120
cognitive writing ensures deep
learning, 120–121
hands-on and real-world learning
experiences deepen learning, 120
thinking deeply about learning helps
encode new learning, 118–119

habits of mind, positive, 38–39
hands-on learning, 16, 120
helplessness, learned, 28
high-level questions and student
explanations
cognitive role, 64–65
empirical studies of, 145f
learning phase related to, 9f
high-level questions and student
explanations, classroom tips for
give opportunities to respond and
explain thinking with peers, 69–70
plan to scaffold thinking about learning, 68
prompt explanations to make thinking
visible, 68
use cold-calling/re-calling to ensure all
students think about learning, 68–69
use wait time, 69
high-level questions and student
explanations, guiding principles
cold-calling versus voluntary response
techniques, 67
encouraging explanations about
thinking supports consolidation, 66
quality is more important than
quantity, 67
questions that prompt thinking about
learning support better learning
outcomes, 65
reflective questions support
consolidation, 66–67
homework, 12, 104, 133f. See also retrieval
practice; spaced, mixed, independent
practice
hypotheses, generating and testing. See
cognitive writing; guided investigations;
structured problem solving
illustrations, conceptual understanding
and, 56–57
implementation, 134–136
improvement index scores, 5
inclusion focus in research, 5–7
inquiry, learning through, 109–111
instruction
enhanced anchored, 15
using the strategies for, 136, 137f, 138
interest in learning
cognitive interest cues for, 14–18
cognitively challenging learning
relation to, 17–18
decreases in, time in school and, 13
hands-on learning relation to, 16
research findings, 11–14
retention of learning and, 14
teaching strategies related to, 9f
tips for cueing, 18–24, 19–20f
interleaved, spaced independent practice,
86–87, 93–94, 149f
investigations, guided. See guided
investigations
knowledge
declarative, pathway for, 137f
procedural, pathway for, 137f
procedural, schematics for, 57–58
socially constructed, 77
knowledge gaps, 18–19
learners
diverse, 138
expert versus novice, 107
learning. See also deep learning; new
learning; specific learning phases
cognitively challenging, relation to
interest, 17–18
consolidating, 63
direct instruction and, 42
goals for rewarding, 27
mental energy required for, 26–27
personal connections relation to
motivation and performance, 16–17
rote, 104
social-constructivist theory of, 77
through inquiry, 109–111
learning gaps, 125–126
learning phases teaching strategies, 9f
locus of control, 29
long-term memory
encoding new learning into, 118–119
interleaving practice for, 86–87
learning through inquiry to enhance,
109–110
repetition for, 85
retrieval practice strategy for, 86–92
make sense of learning
guided initial application with
formative feedback strategy, 70–76
high-level questions and student
explanations strategy, 64–70
peer-assisted consolidation of learning
strategy, 77–82
research findings, 62–64
teaching strategies related to, 9f
manipulatives, conceptual understanding
and, 56–57
memory. See also practice and reflect;
spaced, mixed, independent practice
the brain and, 40–41, 60, 62–63
cramming and, 85
repetition and, 104
working, 60, 63–64
memory, long-term
encoding new learning into, 118–119
interleaving practice for, 86–87
learning through inquiry to enhance,
109–110
repetition for, 85
retrieval practice strategy for, 86–92
memory aids for complex problems, 128
memory storage, 84–87
memory traces, 61
mental models, 107–108, 110, 124–125
meta-analysis studies, 3–5
mindset, growth versus fixed, 32
motivation
anchoring learning in real-life problems
for, 123–124
internal versus external rewards for, 13–14
personal connections relation to, 16–17
real-life problems and, 127, 128f
success and, 12
mysteries, using to cue curiosity, 20
new learning
encoding, 61–63, 118–119
research findings, 40–42
retention time, 39
strategy instruction and modeling
strategy, 50–55
teaching strategies related to, 9f
visualizations and concrete examples
strategy, 56–60
vocabulary instruction strategy, 42–49,
48f, 49f, 50f
nonlinguistic representations, 133f. See also
visualizations and concrete examples
note taking, 133f. See also cognitive writing;
strategy instruction and modeling
objectives, setting, 133f. See also goal
setting and monitoring
optimism, learned, 28
peer-assisted consolidation of learning.
See also consolidation of learning
empirical studies of, 147f
learning phase related to, 9f
purpose of, 77
peer-assisted consolidation of learning,
classroom tips for
chunk lessons to pause and process, 80
embed high-level questions and student
explanations, 80–81, 81f
strategically design mixed-ability
groups, 80
use variety, 81, 82f
peer-assisted consolidation of learning,
guiding principles
complements direct instruction, 78
individual accountability is integrated
with positive interdependence, 78–79
structured activities are key, 78
use mixed ability groups, 79
performance, personal connections
relation to, 16–17
practice and reflect. See also spaced, mixed,
independent practice; targeted support
research findings, 84–87
retrieval practice strategy, 87–92
spaced, mixed, independent practice
strategy, 92–97
targeted support strategy, 97–104, 103f
teaching strategies related to, 9f
prior knowledge
activate to create a knowledge gap,
18–19, 19–20f
cognitive writing exercises to extend
and apply, 113
in consolidating learning, 63
problem solving, 110–111, 123–124. See also
structured problem solving
professions, characteristics of, 1–2
questions. See high-level questions and
student explanations
quizzing to remember. See retrieval practice
real-life problems, motivation and,
123–124, 127, 128f
real-world learning experiences deepen
learning, 120
recognition, 133f. See also goal setting and
monitoring
repetition, memory and, 104
research project, The New Classroom
Instruction That Works
diversity, equity, and inclusion focus,
5–7
effect sizes in, 5–6
improvement index scores in, 5
methodology, 5–7
original and new strategies, 133–134
phases of learning-teaching strategies
relation, 9
practical guidance per strategy, 8
research studies supporting, 139–153
science of learning, links to the, 8
strategies identified, 7–8, 9
retention of learning
a 3 × 3 schedule for, 94–95
curiosity and, 14
interleaving practice for, 93–94
variation in presentation of problems for, 94
retrieval practice
empirical studies of, 148
learning phase related to, 9
purpose of, 87–88, 90
retrieval practice, classroom tips for
balance speeded with reflective practice, 91–92
provide timely correct-answer feedback, 91
quiz more, grade less, 91
retrieval practice, guiding principles
speeded practice supports fluency, not more complex skills, 89–90
understand effectiveness, 88
use timely correct-answer feedback, 89
use to support initial mastery, then repeat, 90
rewards, internal versus external for motivation, 13–14
riddles, using to cue curiosity, 21
scaffolded practice. See targeted support schematics to guide and support procedural knowledge, 57–58, 60
self-explanations for structured problem solving, 124–125
show and tell when demonstrating, 54
similarities and differences, identifying. See cognitive interest cues; structured problem solving
social-constructivist theory, 77
socioeconomic status, success and, 12
spaced, mixed, independent practice
empirical studies of, 149
learning phase related to, 9
purpose of, 92
spaced, mixed, independent practice, classroom tips
build opportunities into unit plans, 95
use the 3 × 3 schedule for independent practice, 97
vary format and presentation of problems, 96–97
vary repeated practice opportunities, 95–96, 96
spaced, mixed, independent practice, guiding principles
a 3 × 3 schedule supports retention, 94–95
interleaving practice supports retention, 93–94
massed practice leads to fast learning and fast forgetting, 93
variation in presentation of problems supports retention, 94
stereotype threat, 29
strategy instruction and modeling
benefits of, 50
empirical studies of, 142–143
learning phase related to, 9
research findings, 51
strategy instruction and modeling, classroom tips for
identify and teach skills to master learning goals, 53–54, 54
teach thinking strategies, 54–55, 55
use show and tell when demonstrating skills and procedures, 54
strategy instruction and modeling, guiding principles
crucial skills need instruction, 51–52
step-by-step demonstration aids effectiveness, 52–53
thinking strategies need taught and demonstrated, 53
structured problem solving
empirical studies of, 153
learning phase related to, 9
purpose of, 123
strategies comprising effective, 126–127
structured problem solving, classroom tips for
anchor learning in complex and relatable problems, 127, 128
help recognize and categorize problem types, 129, 129
provide process and memory aids for complex problems, 128
teach metacognitive skills, 130–131
teach positive self-talk, 130–131
use graphic organizers and drawings to visualize, 129, 130
structured problem solving, guiding principles for
effective assignments integrate other proven strategies, 126–127
problem-solving schemas require instruction, 124
real-life problems enhances motivation and problem-solving skills, 123–124
recognizing problem structures can close learning gaps, 125–126
self-explanations enhance structured problem solving, 124–125
structured problem solving, guiding principles for (cont’d)
think-alouds enhance structured problem solving, 124–125
vocabulary instruction enhances effects of structured problem solving, 125
students, learning about, 24
success
effort’s relation to, 28–29
factors in, 12, 29
fate control and, 29
summarizing, 133f. See also cognitive writing; strategy instruction and modeling
suspense, using to cue curiosity, 21
targeted support
empirical studies of, 150f
learning phase related to, 9f
purpose of, 97–98, 101
targeted support, classroom tips for
ensure Tier 1 instruction provides opportunities for mastery, 101–102
offer to small groups, 102–103
structure as mini learning cycles, 102, 103f
use data for ending, 103–104
use regular checks to prevent failure, 102
targeted support, guiding principles
achievement gaps can be closed, 98–99
formative assessment data is key to targeting learning supports, 99
use to supplement, not supplant, first instruction, 100–101
use trained professionals for effectiveness, 99–100
teacher quality, success and, 12
teachers, professional stature of, 1–2
think-alouds enhance structured problem solving, 124–125
thinking, effortful, 26
thinking about learning
cognitive writing structures
opportunities for, 112
to encode new learning, 118–119
high-level questions to scaffold, 68
questions that prompt support better learning outcomes, 65
use cold-calling/re-calling to ensure, 68–69
thinking made visible, 68, 108
thinking skills, modeling and teaching, 114–115, 115f
thinking strategies, teaching, 54–55, 55f
thrice is nice principle, 76
visualizations and concrete examples
empirical studies of, 144f
learning phase related to, 9f
purpose of, 56
visualizations and concrete examples, classroom tips for
consider what you want students to see and visualize while they learn, 59, 59f
help visualize processes with schematics and diagrams, 60
illustrate abstract ideas with concrete examples, 59
visualizations and concrete examples, guiding principles
illustrations, animations, and manipulatives support conceptual understanding, 56–57
schematics guide and support procedural knowledge, 57–58
use for comprehension of abstract concepts, 57
use worked-out examples to develop new skills and understandings, 57–58
visual/verbal coding, 41
vocabulary instruction
benefits of, 42–43
empirical studies of, 142f
Frayer Model for, 48f
learning phase related to, 9f
for structured problem solving, 125
vocabulary instruction, classroom tips for
consider new words in multiple ways, 48
provide multiple practice and application opportunities, 49
teach age-appropriate academic words, 47–48
use to supplement conceptual understanding, 46
vocabulary learning strategies require instruction, 45
word analysis requires instruction, 45
wait time, 69
worked-out examples, use to develop new skills and understandings, 57–58
working memory, 60, 63–64
writing tasks to support critical thinking, 109
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The Instructional Playbook: The Missing Link for Translating Research into Practice by Jim Knight, Ann Hoffman, Michelle Harris, and Sharon Thomas (#122020)

Learning That Sticks: A Brain-Based Model for Instructional Design and Delivery by Bryan Goodwin with Tonia Gibson and Kristin Rouleau (#120032)

Research-Based Instructional Strategies That Work (Quick Reference Guide) by Bryan Goodwin and Kristin Rouleau (#QRG122037)

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Using Brain Science to Make Learning Stick (Quick Reference Guide) by Bryan Goodwin and Tonia Gibson (#QRG120087)

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