

JAMES M. LANG

small
TEACHING

**SECOND
EDITION**

Everyday Lessons
from the Science of Learning

JOSSEY-BASS™
A Wiley Brand

Preview the Material

It's much easier to put together a jigsaw puzzle if you've already seen a picture of what the completed puzzle should look like. In the same way, a quick, "big picture" overview of a new chapter can give a useful sense of what's going on before you dive into the details.

Chapter 5 *Headings*
The quick, brown fox.

Bold Words

5.1 My wolves quick!

5.2 Six dozen plaid jackets

5.3 Crazy Fredrickson found many very exquisite real pieces

5.4 Jack quickly moved up front and tested the big ball of wax

5.5 Jack quickly moved up front and tested the big ball of wax

Charts

Summary

5.7 Summary

Previewing the text means skimming through the summary and the structure of the book to get a big-picture feel of the text.

Most textbooks are designed with a specific layout that includes the summary, chapter goals, end-of-chapter questions, bolded headings, pictures, and captions. If your book is like this, before you start reading thoroughly, take a few minutes to skim through. What's the big picture—where's the chapter going?

You may not feel that you're learning much from such a quick review, but the point is just to develop a framework that will help later, as you read through at your usual speed. If you find that you get lost in the details as you read, you can do another preview to remind yourself of the big picture.

Contents, pages, language difficulty, content density

See the big picture, know what's going on, make your plan

Contents

Acknowledgments	ix
About the Author	xiii
Preface to the Second Edition	xv
Introduction: Small Teaching	1
Part I <u>Knowledge</u>	
1 Predicting	19
2 Retrieving	41
3 Interleaving	63
Part II Understanding	
4 Connecting	91
5 Practicing	113
6 Explaining	135
✓ Part III Inspiration	
7 Belonging	163
8 Motivating	193
9 Learning	219
Conclusion: Beginning	237
Works Cited	241
Index	249



大家好，我们今晚读第二本书 Small Teaching。这本书可以理解为是分享一些教学小技巧，我们可以从自学的角度去运用这些技巧。作者是那种认真特苦口婆心型，书的内容框架非常清楚，只是可能读起来会觉得有些啰嗦。这也是练习我们阅读耐力的机会——要谦虚，不能满足于“读懂了文字”，要参与写作加上你自己的想法把内容变成2.0版本，并且在阅读中积极运用上个月的所学（还记得什么是 active reading 吗？）以及练习 predicting 的能力。

上面的 PDF 是今天的阅读内容，很多，如果必要预习我会建议 1) 重点看我绿色标记的下划线部分，这些书中值得学习的语言点；2) 内容上 see the big picture 即可，可以认真读两页然后回答这样的问题：这本书的写作风格如何？语言难度如何？我对它有兴趣吗？我会怎么读它？



Acknowledgments

First and foremost, I must express my gratitude for monthly writer's group meetings with Mike Land and Sarah Cavanagh, during which I received wise and helpful feedback on every chapter of this book, both the first and second editions. Mike and Sarah served perfectly as advanced and interested readers, and they made this a better book in every way possible. Special thanks to Sarah for helping me avoid glaring errors in my use of terminology and theories from her home discipline of psychology, and for pointing me to numerous articles that helped thicken my research.

I had the opportunity to present the research from this book—and to test out its applicability to instructors—at many colleges and universities while I was drafting and revising the first edition. So thanks to my hosts and workshop participants at Olds College (Canada), Misericordia University, Regis College, the University of Denver, Fisher College, Florida Institute of Technology, King's Academy (Jordan), MacEwan University (Canada), Indiana State University, the DeLange Conference at Rice University, the University of Texas–San Antonio Health Sciences College, Bucknell University, Georgia Tech, and Columbus State Community College. Thanks as well to the many dozens of institutions around the globe that invited me to share the ideas of this edition with their faculty after the first edition was published. They provided me with a welcome platform to receive feedback upon, and continue to refine the book's theories and models for this second edition.

The seeds for this book were first planted at a meeting with David Brightman at the Teaching Professor Conference in New Orleans, and he was an excellent guide as I worked my way through the conception and proposal stages. His commitment to higher education and to publishing excellent books made him an ideal editor. Pete Gaughan and Connor O'Brien at Wiley proved equally dedicated to the project, and my thanks especially to Connor for his developmental notes on the first draft of the book. The second edition was suggested and shepherded to life by Amy Fandrei, to whom I am grateful as well.

Many colleagues at Assumption University, both faculty and administrative, have been supportive of my work. I am grateful to the University for the two sabbaticals which enabled me first to complete the book and then, six years later, undertake the second edition.

I wrote the vast majority of the first edition at Nu Kitchen in Worcester, Massachusetts. I thank them for all the green tea, about which you will read further in Chapter Two. It seemed to help. The second edition was completed largely at home, as a result of the pandemic. Thanks to DAVIDsTEA for supplying my habit from afar.

burn in → X X runs in a _____
I come from a family of teachers; it must have been something in the water where we grew up. I continue to find inspiration from them, especially from my sister, Peggy, who has served as both teacher and principal to urban student populations in Chicago. Also from my brother, Tony, at whose heels I have been tagging along as a student and teacher and writer and human being since we were childhood bunkmates. My mother was the first teacher in the family, and my father continues to teach me to this day.

Much of my extracurricular thinking about learning happens as a result of observing the experiences of my children, to whom this book is dedicated, so thanks to them for the enthusiasm they have always shown for learning, both in and out of school.

Even more of my thinking about education happens as a result of conversations with my wife, an elementary school teacher. For part of the time that I was writing the first edition, I spent Friday mornings volunteering in her kindergarten classroom, and while I was working on the second edition during the pandemic I could hear her teaching her remote kindergarten classes from the dining room all day long. Observing and hearing her teach reminded me constantly of the incredible value of teaching as a profession and of the selfless commitment that so many teachers make to their students. Those reminders continually renewed my inspiration to write this book.

So a final and most heartfelt thanks to Anne—for everything.

About the Author

James M. Lang is a professor of English and director of the D'Amour Center for Teaching Excellence at Assumption University in Worcester, MA. His books about teaching and learning include *Distracted: Why Students Can't Focus and What You Can Do About It* (Basic Books, 2020); *Small Teaching Online: Applying Learning Science in Online Classes* (with Flower Darby, Jossey-Bass, 2019); and *Cheating Lessons: Learning From Academic Dishonesty* (Harvard University Press, 2013). He writes a monthly column on teaching and learning for the *Chronicle of Higher Education*; his work has been appearing in the *Chronicle* since 1999. He edits a series of books on teaching and learning in higher education for West Virginia University Press; he co-edited the second book in the series, *Teaching the Literature Survey Course: New Strategies for College Faculty* (2018). He has conducted workshops on teaching for faculty at more than a hundred colleges or universities in the US and abroad, and consulted for the United Nations on the development of teaching materials in ethics and integrity for college faculty. In September of 2016 he received a Fulbright Specialist grant to work with three universities in Colombia on the creation of a MOOC (massive, open online course) on teaching and learning in STEM education. He has a BA in English and philosophy from the University of Notre Dame, an MA in English from St. Louis University, and a PhD in English from Northwestern University. Follow him on Twitter at @LangOnCourse, on Instagram at @jimlang7 or visit his website at <http://www.jamesmlang.com>

Preface to the Second Edition

Every year in late December people around the world make resolutions to change their lives. January 1st marks the beginning of new habits and attitudes, new ways of being a good human, and new approaches to the problems and addictions that plague us. I'm one of those people; I especially love to make *big* resolutions. I like it so much I don't limit myself to making them for the new year. My wife has now learned, after many years of living with me, to dread those moments in which I accost her while she's quietly reading her book and pronounce exuberantly: "I've got an incredible idea—it's going to change our lives!" She rolls her eyes, listens to my proposal, nods and smiles, and goes back to her book. She knows to do this because the follow-through on the big resolutions I make typically lasts only until a new one comes along, at which point I track down my wife and let her know that no, that last one was stupid, but *this time* I really have a great idea.

→ Based on the spate of articles that are published every December and January about New Year's resolutions, I'm not the only one that likes to make resolutions that overshoot my attention or stamina. Those articles almost all make the same point: if you want to make resolutions that stick, start small. You might have a big end goal in mind, but if you want to achieve it, you have to launch your efforts with practical and manageable strategies. In early January of 2021, one of those articles pointed me to the work of BJ Fogg, the director of the Behavior Design Lab at Stanford University. In his book *Tiny Habits: The Small Changes that Change Everything* (2020), Fogg argues that we are most likely to affect real

change in our lives when we start with the smallest possible increments we can imagine—if we want to begin developing our upper body strength, for example, we might begin with the plan of doing just two push-ups per day while we are waiting for our coffee to brew. Because that seems like such a small and manageable thing to do, we start the habit, and the habit can then expand until we reach our larger objectives. Our new habits are most likely to stick, Fogg argues, if we can pin them to existing behaviors or moments in our routines (i.e., I always do the push-ups while my tea is steeping) and celebrate our achievements each time we complete the desired behavior (even by just pausing for a moment to congratulate ourselves on another day of doing our push-ups). After I read Fogg's book I was so inspired that I immediately found my wife and pronounced that I had just read something really interesting, and had a great idea about how we could keep our New Year's resolutions and change our lives in the new year. She pointed out that she hadn't made any New Year's resolutions, gave me a nod and a smile, and went back to her book.

Although my non-tiny life resolutions typically don't gain much purchase in my life in the long term, every few years I manage to accomplish one very large task: turning an idea into a book. I don't have a perfect track record on that score either, of course. I make plenty of resolutions to start books that I never finish. But once in a while a big idea emerges that inspires me enough to sit down and start chipping away. In January of 2014, with my failed New Year's resolutions probably fresh in my mind, I wrote the following words in my journal:

Had a good idea for a book project today for Jossey-Bass: the Five-Minute Intervention, or Teaching on the Edges . . . it's about making brief interventions in a traditional class in order to maximize learning. So faculty don't have to start from scratch in re-thinking their

teaching. Grounded in good cognitive theory, they can make 5–15 minute interventions that allow students to engage with the course and increase their learning potential.

That brief entry was the seed that blossomed into *Small Teaching: Everyday Lessons from the Science of Learning*, first published in the spring of 2016 and now appearing in this second edition. I'm not sure any other book of mine has hewn so closely to its original conception from start to finish. The words above describe with perfect accuracy the book that eventually emerged, and still capture exactly what I hope this book can do for its readers: **use research from the learning sciences to offer faculty small, practical changes they can make to their courses in order to improve their students' learning.**

The warm reception that this idea received has been one of the greatest surprises of my life. The book has sold more copies than all of my other books combined and seems to find new audiences every semester. I've received hundreds of invitations to give lectures or workshops on the book's ideas to faculty on college and university campuses around the globe. I wrote a multi-part series for the *Chronicle of Higher Education* on small teaching approaches, and those columns have been the most widely-read articles I have ever written. One of those columns in particular, which focused on how to teach effectively in the first five minutes of class, has proven especially popular. I still see it regularly make the rounds on social media, as someone new discovers the unlocked potential of those crucial opening minutes of the class period. **In the fall of 2019 we published a sequel, *Small Teaching Online* largely the work of faculty development expert Flower Darby, whose many years of researching and practicing online teaching enabled her to apply the small teaching approach to online courses. As this second edition was heading into production, we were finalizing plans for**

the third iteration in the series, *Small Teaching* for elementary and middle-school educators.

The small teaching approach was always designed to have two very different appeals to instructors and institutions. First, I wanted to offer pathways to the improvement of teaching and learning that were manageable for faculty, most of whom already have more work than they can handle in their professional and personal lives: teaching multiple classes, serving on committees, doing research in their disciplines, commuting to multiple campuses as adjuncts, raising children, caring for parents, advocating for social justice, surviving a pandemic, and more. As much as they might want to take deep dives into the literature on teaching and learning, they just don't have the time or energy to do so. I tried to make sure all of the techniques in the book were ones that faculty could put into practice without an excessive amount of new preparation or evaluation time. My hope was that faculty members who read *Small Teaching* or attended one of my workshops three days before the semester starts would still be able to squeeze one or two new teaching strategies into their courses that very semester. But even further, I hoped that faculty members who encountered the ideas from the book in the fifth or even tenth week of the semester could still find something new to try with their students before the course ended.

Second, I hoped that these easy-to-apply teaching strategies could have a powerful positive impact on student learning, performance, and retention. Over the course of my own teaching career I have seen how small changes I have made to my own courses could be transformative—could, for example, revitalize a course that had grown stale or change entirely the extent to which students were engaged with the course material. The connection notebooks that you will read about in Chapter Four are the best recent example of that in my own teaching. Using those notebooks, which take very little class time to complete and which require minimal grading

from me, has transformed the literature survey courses I teach every year. Through the vehicle of those notebooks, students are able to create much deeper and more meaningful connections between their lives and 19th-century British poems they read for the course. They cite those connection notebooks frequently on our course evaluation forms as one of the aspects of the course that was most helpful to their learning.

To ensure that the small teaching strategies I recommended could have such a positive impact, they had to align with a principle or theory I had encountered in the research on teaching and learning in higher education. Those principles became the foundations for the chapters, enabling me to recommend small teaching changes in a systematic way. One of the major reasons that I wanted to produce a second edition of the book has been that my thinking about those principles has shifted over the last five years. This helps explain the most substantive change you will find in the book: the complete overhaul and re-framing of two chapters, one from Part Two and one from Part Three.

The first edition of the book contained a chapter on “Self-Explaining,” which presents research supporting the idea that asking students to talk or write about their learning while they are completing a learning task can deepen their understanding. During the workshops and lectures I gave on the different principles of the book over the last five years, I noticed that this chapter resonated especially with faculty who teach students in more individualized, skill-based settings, such as performing arts or clinical practice in medicine. Faculty outside of those settings had more trouble considering how to incorporate self-explanation in their classrooms. As I reflected on the act of self-explanation, and what made it useful, it occurred to me that *self-explanation* could be considered as one strain of the more general act of *explanation*, and that in fact two of the models in the chapter moved out of the realm of self-explanation and into this more general territory.

Thus, the chapter formerly known as “Self-Explaining” has now been expanded into “Explaining,” and presents models for asking students to explain their learning aloud, either to themselves or to their peers or even to audiences outside of the classroom. The three chapters of Part Two now offer a very logical progression of teaching strategies. Learning deepens when students connect course content to their lives outside of the classroom, practice applying their new knowledge and skills in different contexts, and then explain their understanding to someone else. This last activity, of course, is another way of describing what we do as teachers, and we all know how much the practice of teaching enhances our own learning. The same holds true for our students.

Part Three of the first edition contained a chapter on “Growing,” which drew from Carol Dweck’s research on the growth mindset. Dweck and many others have found that when students believe in the capacity of their intelligence to grow and expand, as opposed to seeing it as fixed and limited, it enhances their ability to learn. The theory of the growth mindset, and its application to education at every level, has been widely promoted and discussed outside of the academy, perhaps more so than any other strategy discussed in the book. The thoroughness of its penetration into educational discourse has prompted the inevitable backlash from those who caution us that instilling a growth mindset into students is no panacea. A fixed mindset is only one of the many barriers that students might face in their efforts to succeed in school, including social and economic ones that require deeper efforts at political change and economic reform. Having acknowledged that, I still see much value in Dweck’s theory and its application to education and believe that teachers should know about it.

At the same time, a few years of reflection have helped me realize that what I really wanted to convey in that chapter were techniques that would help students feel like they *belonged* in their classrooms. They belonged there as learners, no matter what their

prior educational experiences had been, and they belonged there as valued members of our community, no matter what barriers stood in their way outside of the classroom. Understood through that lens, the growth mindset still fits into that chapter, since a student with a fixed mindset might fear that their limited intellectual capacity means they don't belong in their college or even high school classrooms. But Chapter Seven, re-christened from "Growing" to "Belonging," now includes other strategies to promote belonging, all of them built upon the theoretical foundation of an asset-based approach to teaching. Too often we view our students through a deficit lens, seeing what they lack and trying to fill it up with our teaching. But, of course, students bring an incredible array of assets into our classrooms, from their knowledge and skills to their diverse life experiences and cultural capital. The 2020 global pandemic brought to the fore the importance of creating a sense of community in our classrooms, and I believe that teaching strategies that help students feel like they belong in our classrooms provide the most effective route to the cultivation of such community.

The major revisions of these two chapters are the most substantial changes you will find in the book. But you'll find plenty of other changes along the way, including a slight re-ordering of the book's chapters, an expansion of the book's research foundation, and the addition of many new small teaching strategies. Chapter Nine, which has been re-named from "Expanding" to "Learning," provides you with an updated set of resources to continue your own growth as a teacher. I hope that these resources will enable and inspire you to move beyond the models of the book and develop your own small teaching strategies, ones that work for your specific teaching context and your unique communities of students.

I considered one final change to the book that I ultimately did not adopt. The concept of small teaching, as I explain in the

introduction, was first suggested to me by watching two versions of an American sport: professional baseball and amateur softball. For this edition, I thought long and hard about coming up with an alternative way to explain the concept of small teaching for two reasons. First, the book has reached a global audience, and an analogy from an American sport might not resonate with international readers unfamiliar with baseball. This problem was brought to the fore for me as I was speaking with one of the book's translators, who was struggling to find the right way to express the concept for a translated edition. Second, many academics have little interest in sports, and might find the parallels between teaching and baseball less than compelling. I'm not the most passionate sports fan in the world, but I do enjoy watching big games in a few sports and am happy to chat about them with friends and colleagues. One of my friends on the faculty, by contrast, rolls her eyes and heads back to her office anytime the subject of what she calls "sportsball" gets raised in a hallway conversation.

While I don't want to exclude readers like her from connecting with the original conception of small teaching, it can't be denied that observing my daughter's softball games in the summer of 2014, and then watching the World Series games in the fall of 2014 was what helped to transform my journal entry from January 2014 into a fully conceived book. Both experiences demonstrated to me that small changes could have a big impact, and inspired me to see the book through to completion. Thus, you'll still find in the introduction the same explanation of the concept of small teaching that you found in the original, even with its descriptions of "sportsball" games which may have long since faded from memory (unless, of course, you are a fan of the Kansas City Royals). Readers of the first edition might notice, however, that the opening story of the "Prediction" chapter has been changed, and no longer describes the "learning" impact of informal wagering on sports games. I thought the story of my wife's

Small Teaching

“Much of what we’ve been doing as teachers and students isn’t serving us well, but some comparatively simple changes could make a big difference.” (p. 9)

Make It Stick: The Science of Successful Learning

In October 2014, fans of Major League Baseball relished the sight of the plucky ~~Kansas~~ City Royals fighting their way to the final game of the World Series. What captured the attention of so many baseball enthusiasts was that the key to the Royals’ success throughout the season had been an old-fashioned approach to the sport called **small ball**. Rather than relying on muscle-bound sluggers hitting grand slams, the Royals instead utilized the simple, incremental strategies that enable baseball teams to move runners from one base to the next and keep the other team from scoring: bunting, stealing bases, hitting sacrifice fly balls, and playing solid defense. These unglamorous achievements on the field don’t win baseball players the accolades that they might earn from smashing game-winning home runs, but teams who play small ball in concerted and effective ways don’t need those kinds of dramatic heroics. Indeed, some baseball analysts pointed to the success of the Royals, who achieved their victories on a relatively small budget, as evidence of the future of baseball. “The Royals have found a winning formula,” wrote Sean

Gregory, the baseball columnist for *Time* magazine. “These days, if you swing for the fences, you’re more likely than ever to strike out. So just put the ball in play. . .and take your chances with your legs. Steal bases to eke out those diminishing runs. Small-ball is cheap and effective. This is where the game is headed” (Gregory 2014b). **As the article notes, the wonderful feature of small ball is that it’s both effective and inexpensive—and hence available to everyone.** Even teams that spend money on those high-profile sluggers can still play small ball—as was evidenced in the final game of the World Series, in which the bigger-budget San Francisco Giants snatched victory from the Royals by beating them at their own game and scoring two of their three runs on unglamorous sacrifice fly balls (Gregory 2014a).

My own acquaintance with small ball comes from a less dramatic story than the one the Kansas City Royals engineered in fall 2014. I have five children and live in a New England city where love for baseball runs deep. For 15 years I sat on uncomfortable metal benches for 2 months every late spring and watched my children play various levels of softball and baseball in our city leagues. The particular league to which my children belonged was a long-standing one; many of the coaches played in the league when they were children. These coaches frequently took the games quite seriously, perhaps in an effort to recapture the glory of their childhood playing days. As a result, they scouted and selected the best players every year who were coming up from the younger leagues and thus left newer or inexperienced coaches to draft their teams from a much depleted talent pool. Yet, despite the advantages that these more aggressive coaches gained in recruiting the top players, they didn’t always win. In little league as in the major leagues, the coaches who seemed to have the greatest success were the ones who focused their attention—and the attention of their players—on mastering all of the small elements of the game. Small-ball coaches would signal their base runners to steal when

the fielders were haphazardly tossing the ball around the infield, or they would ensure that someone was always backing up a throw to first base in case the first-base person dropped the ball. Since nobody was bashing home runs out of the park on a softball team of 8-year-olds, small ball represented the only guaranteed strategy for long-term success in these youth leagues.

The idea for this book began to percolate at the end of one of those long softball seasons, as I was preparing for a round of fall visits to other college campuses in support of my previous book, *Cheating Lessons*, which was focused on how we can reduce cheating and promote academic integrity in higher education. When I first began giving presentations on this topic, I relished the chance to speak to my fellow college and university teachers about major transformations they could make to their courses. Unfortunately, I was usually making such visits during the middle of a semester, which meant that workshop participants had to wait until the following semester to implement any of my suggestions. Even instructors with the best of intentions to revitalize their teaching might find it challenging to carry what they had learned in a two-hour workshop in October to their course planning in January or August, given all the work that would occupy their minds in the interim. More fundamentally, sudden and dramatic transformation to one's teaching is hard work and can prove a tough sell to instructors with so many time-consuming responsibilities. As a working instructor myself, I teach courses in literature and writing every semester, so I know full well the depth of this challenge. As much as I frequently feel the urge to shake up my teaching practices with radical new innovations, I mostly don't. Reconceiving your courses from the ground up takes time and energy that most of us have in short supply in the middle of the semester, and that we usually expend on our research or service work during the semester breaks.

My reflections on this dilemma led me to consider whether I should incorporate into my workshops more activities that

instructors could turn around and use in their classrooms the next morning or the next week without an extensive ^{work} overhaul of their teaching—the pedagogical equivalents, in other words, of small ball. With that prospect in mind, I dove into the literature of teaching and learning in higher education with new eyes, seeking small-ball recommendations that were both easy to implement and well-supported by the research. Over the course of many months this search led me through the work of cognitive psychologists who study the mechanics of learning, to neuroscientists and biologists who helped me understand some basic aspects of brain science, and to research in learning-related fields such as emotions and motivation. I was pleasantly surprised to find in these fields a manageable number of learning principles that seemed readily translatable into higher education classrooms. Gradually I began searching for practical examples of how these principles could operate in the classroom, and I began recommending some of the strategies I was discovering to participants in my workshops. I could feel the energy and excitement rising in the room whenever participants could see a short road between a late afternoon workshop and a concrete and positive change that they could make in their classes the next morning. But nothing made me more interested and excited than the small successes I experienced when I incorporated some of the strategies I had learned about into my own classroom. Over the course of that fall semester, as I both worked on my own teaching and spoke with other instructors about these ideas, I became convinced of the seemingly paradoxical notion that fundamental pedagogical improvement was possible through incremental change—in the same way that winning the World Series was possible through stealing bases and hitting sacrifice fly balls.

This newfound conviction ultimately gave rise to the notion of *small teaching*, an approach that seeks to spark positive change in higher education through small but powerful modifications to our course design and teaching practices. Small teaching as a

fully developed strategy draws from the deep well of research on learning and higher education to create a deliberate, structured, and incremental approach to changing our courses for the better. The past several decades have brought us a growing body of research on how human beings learn, and a new generation of scholars in those fields has begun to translate findings from the laboratories of memory and cognition researchers to the higher education classrooms of today. Their findings increasingly suggest the potency of small shifts in how we design our courses, conduct our classrooms, and communicate with our students. Some of the findings may also suggest pathways to change that arise from dramatic transformation to our courses, and I applaud those innovators who are pointing us down those routes. But if we are seeking to boost our students' learning of course content, to improve their basic intellectual skills—such as writing, speaking, and critical thinking—and to prepare them for success in their careers, then I believe we can find in small teaching an approach to our shared work of educating students that is effective for our students and accessible to the largest number of working college and university teachers.

Widespread accessibility to working teachers matters a great deal, especially if we consider the incredibly diverse range of contexts in which higher education operates these days. Teaching innovations that have the potential to spur broad changes must be as accessible to underpaid and overworked adjuncts as they are to tenured faculty at research universities. They must find a home on the campus of a small liberal arts college as easily as they do on the commuter campuses of regional comprehensives. They must offer something to traditional lecturers in big rooms and to discussion leaders in small seminars. They should be as available to us in ordinary times as they are in the midst of a pandemic. The activities outlined in this book, taken as a whole, fulfill these directives: with a little bit of creative thinking, they can

translate into every conceivable type of teaching environment in higher education, from lectures in cavernous classrooms to discussions in small seminar rooms, from fully face-to-face to fully online courses and every blended shade between. They stem from very basic principles of how human beings learn and hence cross both discipline and content type—whether you are teaching students to memorize facts or formulae, to develop their speaking or writing skills, or to solve complex and wicked problems. Not every instructor in every discipline in every teaching context will find a space for all of the small teaching activities outlined here, but every reader should find opportunities to use at least some of them. You can implement them tomorrow morning, next week on Friday, in the design of your next quiz or test, and even in the next e-mail you send to your students.

To ensure that these techniques lent themselves to this kind of universal accessibility, and thus merit space beneath the umbrella of small teaching, the principles outlined in this book had to meet three basic criteria. First, they had to have some foundation in the learning sciences. Fortunately, over the past decade or two a cohort of learning scientists has begun to present findings from those disciplines in forms that are accessible to non-specialists like me. Books like Daniel Schacter’s *The Seven Sins of Memory*; Daniel Willingham’s *Why Don’t Students Like School*; or Peter Brown, Henry Roediger, and Mark McDaniel’s *Make It Stick* describe the results of research in neuroscience and cognitive theory in ways that spell out their implications clearly for teachers and learners. Since the publication of the first edition of the book, the roster of such books has only continued to expand. Notable recent titles include Patrice M. Bain and Pooja K. Agarwal’s *Powerful Teaching: Unleash the Science of Learning*; Yana Weinstein, Megan Sumeracki, and Oliver Caviglioli’s *Understanding How We Learn: A Visual Guide*; and Joshua R. Eyler’s *How Humans Learn: The Science and Stories Behind Effective College Teaching*. All of these authors

helped me identify prospective principles for the first edition of the book, and consider some new ones for this second edition.

The principles I selected almost all have solid support from experimental research of one kind or another; they emerge from the labs of neuroscientists, biologists, and psychologists. But in order for a principle to earn a spot as one of the book's chapter titles, it had to meet a second criteria: there had to be at least some research demonstrating that it could have a positive impact outside of the laboratory, in real-world educational environments—higher education—whenever possible. In other words, I had to see published accounts of experiments or qualitative research that demonstrated that this principle could make a demonstrable positive difference to student learning, performance, retention, or well-being. This test proved the most challenging one to meet; some strategies that seemed plausible to me, or that stemmed from fascinating laboratory experiments, did not ultimately make it into the book since they could not clear this essential hurdle.

Finally, I had to observe the principles directly myself somehow, either from my own experiences as a teacher or learner or from direct observation of other teaching and learning environments. Call me overly cautious, but I needed these principles to pass this final smell test for me to be absolutely certain that I could recommend them to working instructors. Most of the chapters that follow begin with an example of how I have sniffed out these principles in some learning experience from my own life or from the lives of my students or even my children, and I hope these personal examples might help you identify moments in which you have seen them at work in your own learning histories as well.

Assuming a teaching and learning activity met all three of these criteria, it still had to be capable of implementation in ways that fell under the umbrella of small teaching. As you will find in the pages that follow, a small teaching approach or activity may take one of three forms:

Brief (5–10-minute) classroom or online learning activities. I love the idea of small interventions in a learning session that can capture (or recapture) the attention of students, provide quick opportunities for student engagement, and introduce or seal up new learning. Even when you have an otherwise busy class session planned, you can find time for a five-minute activity that will provide a substantive boost to the learning of your students.

One-time interventions in a course. As in the case of the Minute Thesis exercise in Chapter Four, the meaning of *small* will occasionally shift from “a small portion of a class” to “a small portion of the course.” In other words, some small teaching activities could occupy an entire class period but need to do so only one or two times in the semester.

Small modifications in course design or communication with your students. These recommendations might not translate directly into 10-minute or one-time activities, but they also do not require radical rethinking of your courses. They might inspire tweaks or small changes in the way you organize the daily schedule of your course, write your course description or assignment sheets, or respond to the writing of your students. The strategies in Part III especially will fit under this category of small teaching approaches.

An essential shared quality of all three of these forms of small teaching is that they *require minimal preparation and grading*. Although we are all busy, this feature of small teaching strikes me as especially important for adjunct instructors, who may be teaching multiple courses on different campuses or working additional jobs to make ends meet. An adjunct instructor who can walk into class every day with a variety of small teaching exercises can actually reduce overall preparation time by seeding these powerful learning activities throughout her teaching. One-time activities

like the Minute Thesis or a mindful practice session, which likewise require minimal preparation or grading, can also serve as a back pocket technique that an instructor could use on a day when a sick child or medical emergency or mental health day has reduced or eliminated normal preparation time.

Yet such activities, which may first find their way into your classroom as a means of filling an empty 10 minutes at the end of class or an unplanned course session, have the power to produce as much or more learning than your anxiously overprepared lecture. For me, this represents the real power and promise of small teaching. I hope the chapters that follow will demonstrate to you that small teaching is not a realist's compromise, an inferior choice we have to make because we don't have the time or energy to make the big changes that would *really* make a difference to our students. We have excellent evidence for the learning power of small teaching activities—in study after study—as you will see in the chapters that follow. Small teaching activities have been proven to raise student performance on learning tasks by the equivalent of a full letter grade or higher. That's powerful evidence—as powerful as anything I have seen in the learning research, including in studies devoted to grand slam approaches that grab the headlines of the *Chronicle of Higher Education* or other publications of our profession.

In further service to the argument that small and incremental approaches can have great power (and to the fact that we are all busy), you will find a variety of levels at which you can understand the small teaching strategies recommended in each chapter. You will have the richest understanding of any given small teaching approach by reading the chapter in its entirety, of course, but you can also drop into the practical application sections in the latter half of the chapters if you are looking for fast and immediate help.

The structure of each chapter includes the following elements:

- **Introduction:** You will usually find here examples of how the particular learning phenomenon described in that chapter might appear in everyday life.
- **In Theory:** This section dives into the research that supports the recommendations of the chapter and includes descriptions of experiments from laboratories and classrooms as well as brief descriptions of key findings or principles from the cognitive sciences.
- **Models:** Four ^{How} or five detailed models are described in each chapter—fully fleshed-out examples of how instructors could incorporate a small teaching approach into their course design, classroom or online practice, or communication with students. This second edition contains a number of new models that I have encountered since the book's initial publication.
- **Principles:** I hope and expect that instructors will not simply follow the models, but also will take the overall strategy and develop their own new models. The principles provide guidance for creating your own small teaching strategies.
- **Quick Tips:** One-sentence reminders of the simplest means of putting the small teaching strategies of that chapter into practice; flip through or return to these when you have 15 minutes before class and need a quick tip for an engaged learning activity.
- **Conclusion:** A final reflection on the main theory or strategy of the chapter.

I hope that your first reading of each chapter will help you see immediately how to make changes to your teaching that will benefit your students. But I hope as well that you can continue to rely on the book long after your first reading. Keep it handy and flip through it every now and again or whenever you feel the need to try something new and different in your classroom. Use the book to spark new or newly invigorated conversations on your campus about how we can best help our students learn and about how

we can best promote positive change in higher education. Finally, when you are ready to further explore the literature on teaching and learning in higher education, and move beyond these specific recommendations, review the reading suggestions in Chapter Nine for more ideas. I have attempted to keep the references in the chapters as spare as possible, in order not to overwhelm new readers to this field or force them to hunt down articles in specialized journals. Throughout the book I sought to support my claims about small teaching, whenever possible, by pointing readers to accessible books that offer good analyses or overviews of the research on human learning.

The small teaching models and principles that you will find in the chapters ahead can be taken singly, as one-time spurs to innovation in a specific course session or unit plan, but they could also be combined to create an entirely new approach to your teaching. If you are reading this book over a break, while you are not teaching, see if you can draw systematically from each of the three major parts of the book as you plan your next course, creating a comprehensive strategy for boosting student learning in your classroom. But if you are reading it during the middle of the semester, shift your focus from the forest to the trees. Select one activity or course modification, and commit to it for the rest of the semester. Make sure you give new activities time to flower; nothing works exactly as we might hope it would on the first attempt, so it might take several iterations before activities like opening or closing prediction exercises really begin to pay dividends. And as I will argue in the conclusion, search for ways to evaluate the effects of your small teaching changes and determine whether they belong in your permanent teaching repertoire. Enlist the help of the teaching and learning center on your campus, if you have one, to help you better understand how to measure the impact of specific changes to your teaching on student learning. Students are not the only ones who will benefit from new learning as the result of

small teaching, in other words; you can use these activities to take a more systematic approach to your own teaching, thinking deliberately about implementing, measuring, and modifying a range of possible teaching strategies in ways that will keep you learning and growing as a teacher throughout your career.

But we shouldn't get too far ahead of ourselves, and worry yet about your whole career. I will assume that you have class tomorrow, or next Monday, or at least within the next month or two, and you're looking for ideas.

Let's start small.

Knowledge



clickbait eye-catching
 Imagine the media storm that erupted in 1956 upon the publication of an educational book with the attention-grabbing title of *Taxonomy of Educational Objectives: The Classification of Educational Goals, Handbook I: Cognitive Domain*. The author of this spine-tingling was psychologist Benjamin Bloom, who sought to articulate a set of objectives that teachers could use to guide their instructional activities. In spite of its eye-glazing title, the book's content ultimately became a sacred text for educational theorists and administrators everywhere, giving them both a conceptual framework and a vocabulary to articulate what they expected learners could achieve in their classrooms. The taxonomy that Bloom created contains six major categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. A quick glance over the six categories would suggest that they follow a progression from lower to higher orders of complexity, from a static possession of knowledge to more creative forms of thinking in the categories of synthesis and evaluation. Indeed, the taxonomy is often depicted in the shape of a pyramid, with knowledge at the bottom and evaluation or creation at the apex.

Unfortunately, this visual image of Bloom's taxonomy as a pyramid, which all teachers have likely encountered at some point in their lives, has led many higher education instructors to view Bloom's categories in a distorted way. When you think of a pyramid, after all, where do you want to be? At the top, of course. Nobody wants to be down on the bottom row of a pyramid, crushed by the weight of the rising layers, unable to reach for the cognitive stars. So some instructors seem to believe that the learning of facts or concepts, or helping students remember facts and concepts—or even procedures or basic skills—falls beneath them; they are interested only in higher order activities like critical thinking or making judgments or creating new knowledge. College instructors seem especially prone to this desire to hop over the bottom layer of the pyramid—or, more charitably, to assume either that elementary and secondary educators should have helped students learn how to remember things or that students should master knowledge outside of class and class time can be exclusively devoted to higher cognitive activities. In recent years such instructors have used a new argument to justify their dismissal of the knowledge category of Bloom's taxonomy: the omnipresence of search engines. Why should we bother to help students remember facts, so this argument runs, when all of the facts of the entire world are available to them at the touch of a fingertip? Facts now come in the form of smartphones. Let the Internet provide students with the facts, and we will instead focus our energies on the higher cognitive activities that make use of those facts.

Appealing though it might be to offload the responsibility for teaching our students basic knowledge to their elementary school teachers or to Google™, the research of cognitive psychologists who study learning and the basic study habits of most students suggest that we cannot do this. One of our first and most important tasks as teachers is to help students develop a rich body

of knowledge in our content areas—without doing so, we diminish considerably their ability to engage in cognitive activities like thinking and evaluating and creating. As cognitive psychologist [Daniel Willingham has argued, you can't think creatively about information unless you have information in your head to think about.] "Research from cognitive science has shown," he explains, "that the sorts of skills that teachers want for their students—such as the ability to analyze and think critically—*require* extensive factual knowledge" (Willingham 2014, p. 25). We have to know things, in other words, to think critically about them. Without any information readily available to use in our brains, we tend to see new facts (from our Internet searches) in isolated, noncontextual ways that lead to shallow thinking. Facts are related to other facts, and the more of those relationships we can see, the more we will prove capable of critical analysis and creative thinking. Students who don't bother to memorize anything will never get much beyond skating over the surface of a topic.

But the issue runs more deeply than this. When we learn new facts, we are building up mental structures that enable us to process and organize the next set of new facts more effectively. Knowledge is foundational: we won't have the structures in place to do deep thinking if we haven't spent time mastering a body of knowledge related to that thinking. The depiction of Bloom's taxonomy as a pyramid actually does acknowledge this important principle; one cannot get to the top levels of creative and critical thinking without a broad and solid foundation of knowledge beneath them. As Willingham puts it, "Thinking well requires knowing facts, and that's true not simply because you need something to think *about*. The very processes that teachers care most about—critical thinking processes such as reasoning and problem-solving—are intimately intertwined with factual knowledge that is stored in long-term memory (not just found in the environment)" (Willingham 2014, p. 28).



In his book *Curious*, Ian Leslie argues that such knowledge is “the hidden power” of our cognition (Leslie 2015, p. 121); the more of it we have, the more deeply we can think.

As a simple illustration of the intertwinement of facts and thinking, consider the example of a lawyer who has to build an argument over the course of a trial, responding on short notice to witnesses or actions by the judge. We might think about a lawyer who works skillfully in such a situation as an adept and creative thinker, one who can respond quickly on her feet and construct arguments with facility. But if we listen to her making those arguments, we are likely to hear lots and lots of facts: legal principles, examples from other famous cases, statements from other witnesses, and so on. Undoubtedly, the lawyer in this case demonstrates complex cognitive and creative skills in building arguments from facts, but no such thinking will arise without those facts. More important, the lawyer’s gradual mastery of a body of facts, over the course of years of study and legal practice, enables her to take what she is encountering in this trial and invest it with meaning by connecting it with previous cases and trials, thus better preparing her for her next round of critical thinking in the courtroom. Likewise, I know that if I ask students to think critically about the meaning of a Romantic poem in my literature survey course, the student with a deep factual knowledge of the historical context in which it was written will offer me a better analysis than the one who just eyeballs it and Googles™ a few facts at random. We need factual material in our memory for every cognitive skill we might want to teach our students.

We should not assume that students are either willing or capable of mastering such foundational knowledge on their own, in their study and learning outside of the classroom. In fact, research on student learning strategies suggests that students typically make poor choices when they attempt to learn new information—and that they make those choices even when they know better.

Brown, Roediger, and McDaniel, the authors of *Make it Stick: The Science of Successful Learning*, describe a fascinating experiment in which students were given two different strategies for learning how to identify characteristics of the work of different painters: studying the paintings either in similar groups (i.e., massed studying) or all mixed together (i.e., interleaved studying). The students who studied the paintings in interleaved fashion performed better on tests they took after their study periods—but this did not seem to make a difference in how they thought about studying, as the authors explain: “Despite [the] results, the students who participated in these experiments persisted in preferring massed practice, convinced that it served them better. Even after they took the test and could have realized from their own performance that interleaving was the better strategy for learning, they clung to their belief that the concentrated viewing of paintings by one artist was better” (Brown, Roediger, and McDaniel 2014, p. 54). In other words, these students continued to believe in the superior power of a study strategy that had just been demonstrated to them as less effective than a simple alternative. → old habits die hard.

Like all of us, these students suffered from biases and misconceptions about learning and how it works. Tell students to study for a test, and most of them will pull out their notebooks or textbooks and read them over and over again, despite scads of research telling us that this is just about the least effective learning strategy for mastering a new body of information. Even if students have encountered this research or have been taught effective study strategies by previous teachers, they still are likely to persist in ineffective learning strategies.

Hence, if we care about students having knowledge that they can use to practice their higher order cognitive skills, we should help them acquire that knowledge. We might rightly not want to spend an extraordinary amount of time and energy on this aspect of their learning, which is what makes it such a perfect realm for



small teaching. As you will read in what follows, small teaching activities in the realm of prediction, retrieval, and interleaving can all provide significant boosts to your students' mastery of foundational knowledge and skills. Such activities, leveraged into the first and final minutes of a class session, can provide a powerful boost to student mastery of knowledge; so, too, can simple tweaks to the organization of your course and the order in which you introduce new material and review older material. Taking advantage of these easy opportunities to help students remember course material will ensure that students can engage more deeply and meaningfully in the complex learning tasks to which you want to devote more of your time and energy—and to which we give more full consideration in Part Two.

science has shown," he explains, "that the sorts of skills that teachers want for their studentssuch as the ability to analyze and think critically—require extensive factual knowledge" (Willingham 2014, p. 25). We have to know things, in other words, to think critically about them. Without any information readily available to use in our brains, we tend to see new facts (from our Internet searches) in isolated, noncontextual ways that lead to shallow thinking. Facts are related to other facts, and the more of those relationships we can see, the more we will prove capable of critical analysis and creative thinking. Students who don't bother to memorize anything will never get much beyond skating over the surface of a topic. [笔记Small Teaching](#)

💡 过去经常说「知识不是力量」，这个信息时代知识可以唾手可得，更重要的学会学习、学会应用和创造。这种想法暗含着[Curse of Knowledge](#)，也带着一种不自觉的傲慢：知识并不是一触之遥，知道去哪里找知识、如何过滤提取整合信息这都需要能力。听起来这是一个Catch 22: 你需要有知识储备才能让大脑思考，你需要会思考才能有效地储备知识。那可以怎么做呢？我想：

- **作为老师：**整理必要知识以及这个知识的体系，分享「为什么要学这个？」「XX和YY之间有什么联系？」 Small Teaching 中的这个编排思路就是很好的参考：

- **Introduction:** You will usually find here examples of how the particular learning phenomenon described in that chapter might appear in everyday life.
- **In Theory:** This section delves into the research that supports the recommendations of the chapter and includes descriptions of experiments from laboratories and classrooms as well as brief descriptions of key findings or principles from the cognitive sciences.
- **Models:** Four or five detailed models are described in each chapter—fully fleshed-out examples of how instructors could incorporate a small teaching approach into their course design, classroom or online practice, or communication with students. This second edition contains a number of new models that I have encountered since the book's initial publication.
- **Principles:** I hope and expect that instructors will not simply follow the models, but also will take the overall strategy and develop their own new models. The principles provide guidance for creating your own small teaching strategies.

- **作为学生：**学知识，更要学思路，主动模仿，一边乖乖听话一边要「多长个心眼」。

我做的英语教学比较特别，不教应试也不是传统的课堂，但这样的思考是有必要的。想了想我的知识积累到应用，主要是来自课堂、阅读、日常生活中的随手查，以及保持记录、分享、以教为学。想到这里，还是觉得自己很幸运，一路都有人鼓励我，做我的灯塔，有人相信我愿意和我一起走一段路。

Chapter 1

Predicting

INTRODUCTION

My wife, Anne, teaches kindergarten, and during the 2020–2021 school year she taught it remotely from our dining room. Whenever you find it challenging to maintain the focus of your students, you should envision attempting to corral the attention of a couple of dozen five-year-olds through your computer screen and feel just a little bit better about your prospects. I was working from home as well during the pandemic, and so I had the pleasure (I think) of overhearing almost everything she did with her students all day long. I hummed along to the songs she sang about the weather and days of the week, counted my way to one hundred by ones and fives and tens, and listened to her patiently introduce letters and syllables and words to her students.

At some point every day she would read a picture book to the faces gathered on her screen, and this process always started in the same way. She would display the cover of the book, read aloud the title, and then ask her students some variation of the following question: “What do you think this book is going to be about?” She would then pose additional questions based on the specifics of the picture and the title. “What do you think will happen if you give a mouse a cookie?” “What would it be like to take a polar bear for a walk?” A final set of questions was designed to surface whatever students already knew about the subject matter

of the book: “Where do polar bears live? Are polar bears pets?” The students would sing out their answers, some of which were on target and some of which were not. (Polar bears do NOT make good pets.) But almost always the process of reading a story aloud to the students began with a few minutes of these efforts by the students to make some predictions about what would unfold in the story they were about to hear.

In higher education we tend to go into class with our content guns blazing: I HAVE SOME STUFF TO TEACH YOU, LET’S GET STARTED! But the research on human learning that we will consider in this chapter suggests that the first step in the learning process should be to follow Anne’s lead—not necessarily through her specific activity of asking pre-reading questions—but by asking students to engage in predictive activities of some kind or another *before* we expose them to new course content. Such activities could include inviting students to answer questions about what they are about to learn or experience, but could also include asking students to solve problems that are beyond their current ability level or to try their hand at a new skill before they have been given any formal instruction. This approach can seem counterintuitive since it turns the normal teaching sequence on its head. The operating assumption of many teachers runs like this: *First* I teach them the material, *then* I have them answer questions or solve problems with it. Read the story about polar bears, and then ask them where polar bears live. Give students a lecture on poetry, and then have them interpret a poem. Show students how to solve a particular type of math problem, and then give them one to solve on their own. But learning research suggests something quite different. It tells us that asking students to use their existing knowledge and skills to struggle with the material *before* we teach it can provide a robust foundation for deeper learning.

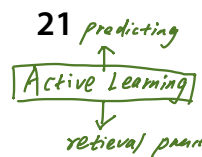
Providing opportunities for students to undertake this struggle doesn’t take much time or effort, which is why it makes

an ideal place to start a book on small teaching: just a few minutes at the beginning of a class period or a unit or even a course has enormous potential to improve both student learning and your teaching.

IN THEORY

To understand how and why predictive activities support learning, consider first an elegant series of experiments conducted by three researchers at UCLA (Kornell, Jenson Hayes, and Bjork 2009). The authors asked subjects in one of these experiments to memorize a series of loosely connected word pairs, such as *whale–mammal*. One group of the subjects was given 13 seconds to study each word pair; the other group was given 8 seconds to see only the first word and to make a prediction about the second, after which they had 5 seconds to see the full word pair. Since the second word of the pair was linked to the first, but only one of many possibilities (since you might well guess *sea* or *ocean* or *large* if you saw only the word *whale*), participants typically guessed the second half of the pair incorrectly. Note also that the subjects in the second (prediction) group had only 5 seconds to view the correct answer, so 8 seconds less than those in the first (nonprediction) group. Yet in spite of this shorter study time, and in spite of the fact that subjects in the second group frequently predicted the second half of the word pair incorrectly, the subjects in the second group performed significantly better than those in the first group when they were asked to recollect the word pairs on a subsequent exam: 67% accuracy in the second group versus 55% in the first. The unsuccessful prediction attempts in the experimental group, the authors explain, “were, remarkably, more effective than was spending the same time studying the answer to be recalled later” (p. 994). In other words, taking a few seconds to predict the answer before

→ ☆ 猜查并记



learning it, *even when the prediction was incorrect*, seemed to increase subsequent retention of learned material. This was true even when that prediction time substituted for—rather than supplemented—more conventional forms of studying.

The results of laboratory experiments like this one prompted another group of researchers, led by cognitive psychologist Elizabeth Bjork, to see whether they could reproduce the positive learning effect of prediction in an actual classroom (Carey 2014b). The researchers gave students in Bjork’s introductory psychology class short multiple-choice pretests before some of the lectures in her course. Since the pretest questions asked them about material that had not yet been covered, the students performed about as well on the pretests as they would have from guessing randomly—again, as in the laboratory experiment, they made plenty of wrong predictions. Lectures on the subject matter followed immediately after the pretests, so the students received quick feedback on their answers. At the end of the term, the students took a final exam that contained multiple-choice questions similar to the ones on the pretests. The results paralleled the results of the laboratory experiment almost exactly: students performed around 10% better on questions from the subject areas in which they had been pretested than on those on which they had not. Bjork concluded from this experiment that “giving students a pretest on topics to be covered in a lecture improves their ability to answer related questions about those topics on a later final exam” (Carey 2014b). Note, of course, that even though the vocabulary has changed slightly here—from *prediction* to *pretesting*—the cognitive activity is similar: asking learners to give answers to questions or anticipate outcomes about which they do not yet have sufficient information or understanding. They are trying before they are ready.

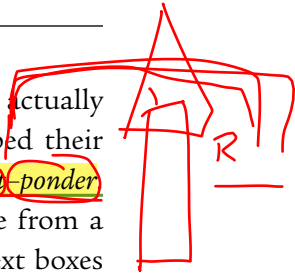
Before we explore the reasons that prediction boosts learning, ^{for}consider one final example of prediction in higher education, this one from an online environment (Ogan, Aleven, and Jones 2009).

Three researchers from Carnegie Mellon University developed an online tutoring program that demonstrated the power of predicting in helping students improve their intercultural understanding in hybrid language courses. The two French courses described in the experiment each met once a week in a face-to-face environment, but otherwise the students did their course work online. Part of the goal for these courses was to help students develop what the authors called “intercultural competence, that is, the ability to think and act in culturally appropriate ways” (p. 268). This can be an extremely difficult skill to develop, as anyone who has ever traveled in a foreign country can likely attest. The ability to speak the language of a foreign country ~~does not necessarily~~ guarantee your ability to understand how to hail a cab, tip in a restaurant, or approach a stranger in the Paris Metro to ask which train will take you to the airport in time to catch your flight home (as I once discovered, to my great sorrow). So, in this experiment we are moving beyond the realm of simply knowing and retaining information into the broader realm of comprehension—that is, understanding how to use and apply in other contexts the information you have learned. The intercultural competence sought by these instructors requires learners to think and act with their knowledge, not just report it back.

To help students acquire this type of deeper comprehension, two experts in computer-assisted learning worked with a language professor to develop an online tutoring program based on the use of film clips. In the control condition of this experiment, students were shown film clips highlighting cultural attitudes or behaviors that are normally taught in introductory French classes. As the students watched the short film clips, they had the opportunity to take notes on what they saw. The students in the experimental group, by contrast, were given the opportunity to use the power of prediction to improve their learning. Their film clips would pause at key moments, ask them to make a prediction about what was

about to unfold, and then require them to ponder what actually happened once the clip had finish: the authors described their three-part sequence with the catchy phrase pause-predict-ponder. The prediction the students had to make actually came from a drop-down menu of choices, but then they had open text boxes to explain why they made that prediction. After they had watched the remainder of the clip, they had to answer a simple question about whether or not their prediction was correct and then respond to prompts to help them reflect on their prediction, such as: “If so [i.e., if your prediction was correct], did you see anything you didn’t expect about the French culture? If not, what happened that you didn’t predict?” Students in both conditions concluded their viewing of the film clips with required postings to a discussion board to allow them to process and review what they had seen.

After the class, the researchers looked at two different measures to see whether the pause-predict-ponder exercises had improved student mastery of intercultural competence: student scores on tests of cultural knowledge, and their more general cultural thinking or reasoning skills through their discussion board posts. The students who had the opportunity to make predictions outscored their peers on the first exam by about that same 10% margin that we saw in the earlier experiments, with some diminishing returns on the subsequent assignments—which might tell us that prediction, like many of the active learning interventions we will consider in this book, especially helps new learners. Ratings of the posts in the discussion board also showed the students in the experimental condition performing significantly higher on assessments of intercultural competence than those in the control condition. In the discussion of their results, the researchers note that students made correct predictions only about 40% of the time, another point in favor of the notion (to be qualified shortly) that wrong predictions do no harm. They also point to an



interesting side benefit they witnessed: students in the experimental condition posted more frequently on the discussion boards, and more frequently on target, than those in the control condition: “The experimental group showed a better ability to maintain a productive discussion compared to the control group (p. 283).” It seems that in this case the prediction activity also helped engage the students more thoroughly in the material. 

Researchers who study the brain can help clarify the mechanisms that underpin the results of all of these experiments. Neuroscientists are increasingly demonstrating that our brains are prediction-making machines, and that our learning stems most fundamentally from the cycle of making predictions and then adjusting our thinking in light of the accuracy of those predictions. Stanislas Dehaene is a professor of experimental cognitive psychology at the College de France, and the Director of the Neurospin Brain Imaging Center. In his book *How We Learn: Why Brains Learn Better Than Any Machine . . . for Now*, he offers a detailed but accessible tour of learning and the brain, and concludes that “Generating a prediction, detecting one’s error, and correcting oneself are the very foundation of effective learning” (Dehaene 2020, p. 209). Our brains continuously create models of the world around us, use those models to predict how our experiences will unfold, and engage in corrective re-modeling in light of what actually happens. That corrective re-modeling is what we call learning. A new driver’s brain makes continuous predictions about how the car will behave as she drives—she expects the car to slow down and come to a stop when she brakes. The first time she drives in the snow, applies the brake, and finds herself skidding, her brain notes the failure of her existing mental model—applying the brakes doesn’t *always* stop the car with the same efficacy. She has to take weather conditions into account. Her mental model of driving expands, her predictive abilities as a driver improve. She has learned.



longman
How to Teach Pronunciation

朗文出版的 How to Teach Pronunciation 中提到，老师只能教给学生一些 basic rules。想真正掌握它的话，需要“**脑袋琢磨起来，嘴巴动起来**”：用脑袋去琢磨你听到的声音，分析它的断句、重音和语调模式；然后动口去模仿，把一句话练到极致。

Tools

Is it the blue one? ... No? Is it the red one, then? ... OK, is it the green one?

It is clear that the list above doesn't adequately cover the range of possible intonation choices available to speakers. However, it is also true that the teacher who applies these rules to their treatment of intonation in the classroom is unlikely to lead students astray; that is to say that in using these patterns, students will not go drastically wrong. The rules may not cover the full range of possibilities, but neither do they create problems. To make an analogy, a driving instructor cannot hope to teach all driving manoeuvres that exist to a student, yet those they do teach will enable the student to cope on the road and give them the confidence to discover more as they gain experience. Likewise, in teaching grammar we do not teach students everything there is to know about the present perfect the first time it is introduced. We give some basic rules with the aim of showing students how it can be used in certain situations. If they apply these rules students will not go wrong, but neither will they have covered the full range of possibilities.

The following sample lessons show some different ways in which the links between intonation and grammar can be practically used in the classroom. In line with the classification of lesson types described on page 14, the examples show intonation issues being Integrated with the teaching of a language point, being dealt with Remedially and being Practised in their own right. They also cover a range of different levels.

📖

学习的本质是对比

×

+

🔍

Zettelkasten / Literature Box / 学习的本质是对比

📄

:

Tag: ideas

From: [[笔记Small Teaching]]

Idea

💡

In his book *How We Learn: Why Brains Learn Better Than Any Machine ... for Now*, he offers a detailed but accessible tour of learning and the brain, and concludes that "Generating a prediction, detecting one's error, and correcting oneself are the very foundation of effective learning" (Dehaene 2020, p. 209).

学习的本质是「比较」。新知识和旧知识的比较，自己会怎么做和他人会怎么做的对比，「我以为」和「实际上」的对比。有了比较的意识和能力，才能吸收消化、模仿，有效学习。那如何提升这个比较能力呢？Pause-Predict-Ponder 是个必要养成的习惯。

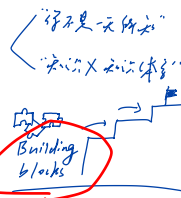
- **Pause**: 需要你主动停下来考自己；
- **Predict**: 在比较前先想「我以为.....」「如果是我.....，我会.....」
- **Ponder**: 给自己的 predicting 加一个「因为.....」

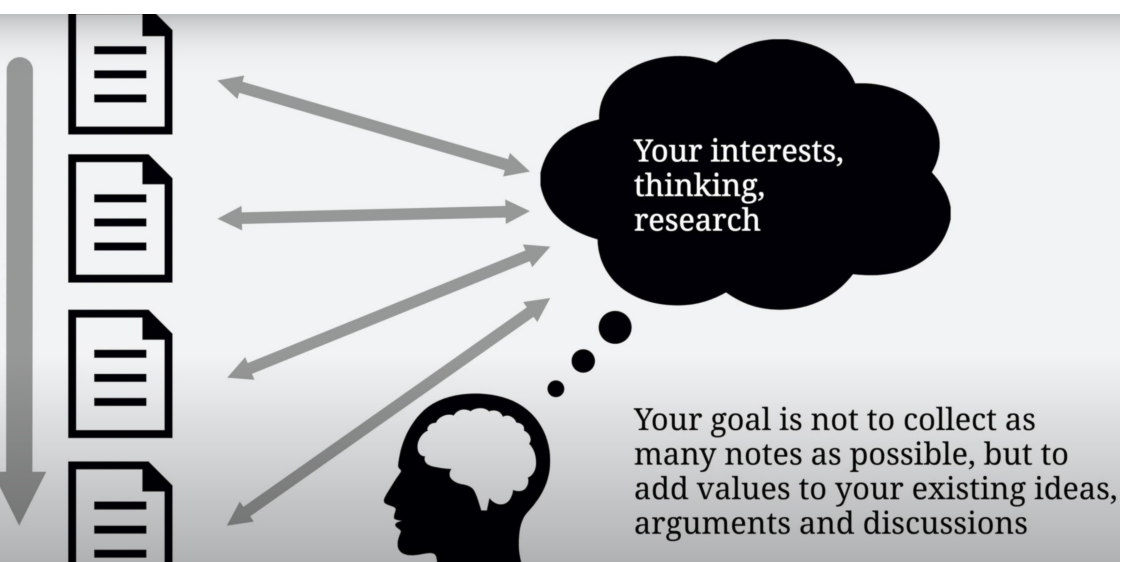
这样想「比较」就可以拆解为：Generation (学前先做) - Predict (学中预判) - Correct/Calibrate (学后校正) —— Acronym: GPC (👉) As Daniel Willingham has argued, "Memory is the residue of thought" (Willingham 2014, p. 54). 这样做的顺带好处是可以加深记忆，让知识点变成线和面，视剑打造自己的知识体系。看起来更麻烦、更费力，但比起死记硬背的辛苦和效果，这样做性价比更高。hazard a prediction, 对与错都不重要，把 predicting 当做一个游戏：猜对了更好，那就要想为啥对了呢？是蒙的还是有依据？猜错了也很好，是没有 mental models and prior knowledge 可以调用还是什么？这样一来，对错都能提供情感价值，你可能会沾沾自喜然后更愿意多学一点，也可能会「哇，原来如此！」而对学习多了点好奇。

这个思路放在词汇学习上，简直大材小用。把它放到人生问题上，会让你的世界多一些乐观和积极。

In a classroom setting, predictive activities reveal to students the gaps and problems in their existing knowledge of the course subject matter and provoke them to fill and repair their understanding. When I am asked to make a prediction or try a new skill, I am forced to surface whatever knowledge and skills I currently possess and use them in service of the task in front of me. In some cases, I will see immediately that I don't have what I need—I *have no idea how to do this*, I might think to myself. In a classroom setting, that recognition should push me toward learning: *If I want to succeed in here, I need more information*. But I might equally well think I *do* have enough information or skill to get the job done, in which case I will make a confident prediction, assuming that I already know everything I need to know. When I discover that my prediction was incorrect, I am put back on my heels again. What went wrong? What information was I missing? What would I have needed to know in order to get it right? Since very few students, if any, will come into our classes knowing everything they need to know already, the predictive activities we design are likely to reveal at least some errors in their thinking, showing them the gaps in their knowledge and skills. Ideally, your course material then gives them precisely what they need in order to fill those gaps.

Predictive activities can also give students a clearer understanding of what and how they need to study and learn in any particular course. As Elizabeth Bjork points out in relation to the practice tests in her experiments, “Taking a practice test and getting answers wrong seems to improve subsequent study, because the test adjusts our thinking in some way to the kind of material we need to know” (quoted in Carey 2014b). Well-planned pretests or predictive activities alert the students to essential course content and the testing style of the instructor. Envision a student sitting in a chemistry course in the fall semester of her first year of college. She had a year of chemistry in high school, and her high

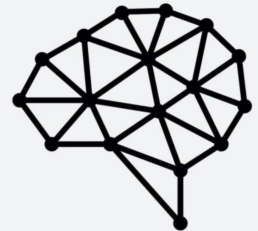




What you
just learned



What you
already know



1. The more information = more hooks we can use to connect new information to.
2. The more connected information = more cues we can use to trigger the right memory

school teacher focused entirely on having students memorize facts and formulae, knowledge of which he assessed exclusively through multiple-choice tests. She has been conditioned by that teacher to think about and learn chemistry through rote learning, a memorization technique she will carry into her new course—unless, of course, her college professor opens the semester by asking the class to try to answer some conceptual questions, and mentions that these problems are similar to ones that will appear on the final exam. When that first-year student finds herself scratching her head and unable to come up with the answers, she will immediately see that she has to approach this course, and her learning, in a new way. She has to focus on conceptual understanding instead of the memorization of facts. If she hadn't encountered that first-day predictive activity, she might have spent the first five weeks of the semester, before the first major exam, focused entirely on repeating her high school study practices.

Ultimately and perhaps most simply, predictive activities mimic something we normally ask of learners who are attempting to master a skill: requiring them to *try before they are ready*. We can all likely draw from our experiences with attempts to master skills of one sort or another, and we know full well that however much one might read in advance about throwing a football or painting a portrait or giving a speech, the real learning happens after we have thrown ourselves into the situation and made that first (unsuccessful) attempt. When I took a class to become licensed in scuba diving, we spent the first half of every session in a classroom taking notes on some skill we would have to practice in the pool. I typically jumped in the pool for the second half of class thinking I had that skill mastered, but within a few minutes the gaps in my knowledge were revealed, and I floundered around for a while, doing it completely wrong until the instructor swam over and gave me the help I needed, at which point the real learning began. !

We facilitate this type of learning in many academic contexts, asking students to try out cognitive skills before they are ready. I don't spend the entire semester lecturing to my freshman composition students about all of the writing techniques they will need to write a perfect academic essay and then give them one final assignment to show me how they have mastered those skills. I assign essays from the beginning of the semester, even though some of what they need to write great academic essays won't be covered for another 4 or 8 or 12 weeks. Asking students to make predictions before learning new material just represents another version of this common teaching approach.

MODELS

The ideal grounds for small teaching activities related to prediction are the openings of a learning experience—a course, a learning unit, a class period. Consider the following models for leveraging predicting into the beginning of anything you might be teaching.

Activating Prior Knowledge

Engaging in an act of prediction begins with my rooting around in my brain for anything which I already know that will help me make a successful prediction. It requires me to tap into my existing knowledge and skills, whatever they might be. I use my existing knowledge of French culture to predict what will happen in the video, or my prior knowledge of chemistry to predict what will happen in an experiment. This *activation of prior knowledge*, as learning researchers call it, has been demonstrated as having plenty of power to boost learning. “Prior knowledge plays a critical role in learning,” explain Susan Ambrose and Marsha Lovett, “which

means that. . .faculty members need to assess the content, beliefs and skills students bring with them into courses and. . .use that information as both a foundation for new learning as well as an opportunity to intervene when content knowledge is inaccurate or insufficient” (Ambrose and Lovett 2014, p. 16). The easiest way to activate the prior knowledge of your students is to ask them to make individual and collective knowledge dumps, telling you everything they know—or think they know—about your subject before you begin teaching them. You might think about this as a pre-prediction activity, or a half-step toward prediction. Instead of drawing up their prior knowledge and using it to solve a new problem, students are simply drawing up that prior knowledge and showing it to you—and the research suggests that this step on its own, *even if they don’t use their prior knowledge to solve a new problem*, can prepare them for deeper learning.

Our first small teaching strategy might therefore be the easiest one to implement in the book: before you teach something new to your students, ask them what they already know about it. You could do this in multiple ways that fit the frame of small teaching:

- Prior to introducing new content in a course, ask students to take a pre-quiz or respond to two or three questions about the subject matter on the course’s learning management system and then summarize those results briefly at the start of the first or second class.
- At the start of any individual class period, ask students to write down what they think they already know about the subject for that day. Tell them to list three to five things they have learned in previous classes or from their life experiences, and have them pair up to compare notes. Solicit a few responses and build on them in the opening of your presentation of the new material.

- At the start of the semester, devote part of one class period to assessing students' current state of knowledge, either through whole-class or group activities or through a written pretest. Once you have heard what students have to offer in such an exercise and have gained a glimpse into their existing knowledge, you can strategize how to build upon it most effectively in the course.

As an example of the third suggestion, when I teach a seminar on twenty-first-century British literature and culture, I set aside 30 minutes on the first day of the semester for a knowledge dump in which students respond to the following question: "When I say the word *British*, what are the primary impressions that form in your mind?" I pose this question and give them a few minutes to make a list on paper, and then we fill up the board with their impressions. I try to categorize their impressions so we can see patterns—and the same basic patterns always emerge. *British* to them means the royal family, traditional activities like having tea and biscuits or taking long walks in the country, green landscapes, and ruined castles. None of them ever mention the ethnic diversity of Britain, or the fact that *Britishness* encompasses the peoples of Scotland and Wales and Northern Ireland, or its recent political history. The second class period, in which we begin considering the political and cultural context of British literature, then gives me an opportunity not to dismiss their impressions but to build upon them as I introduce features of Britishness that they have never encountered. Throughout the semester I will occasionally return to the impressions we laid out on that first day and remind them about how our current text or discussion connects back to them. Such an opening-class activity can obviously work in almost any type of course, modified in ways that best fit your inclinations. For an upper-level course you might want to narrow down the questions, since they might have more general extensive

knowledge than would fit into a paragraph. The overall strategy here remains happily simple: prior to the introduction of any major new chunk of course content, spend a class period (for a whole course) or a few minutes (for a new unit) asking them what they already know.

Polling Predictions

The use of classroom polling—whether you go high-tech with programs like Poll Everywhere or low-tech with colored index cards or even just raised hands—presents a very simple route to making prediction part of your course lectures, as Derek Bruff points out in his book *Teaching with Classroom Response Systems: Creating Active Learning Environments* (Bruff 2009). His chapter “A Taxonomy of Clicker Questions” points to the power of prediction to increase comprehension in addition to the benefits it should provide in boosting memory of individual facts and concepts. For example, Bruff gives an example of a math instructor at a small college who “shows his students a graphing program that allows him to vary a parameter in a function, such as the parameter ω in the function $\sin(\omega t)$, and asks his students to predict what will happen to the graph of a function when he changes that parameter. After the students vote with their clickers, he demonstrates the correct answer using his graphing program” (p. 85). Students cannot answer questions like this with simple plug-and-chug-type knowledge; they have to possess a conceptual understanding of the problem to make an accurate prediction. The failure or success of their predictions enables them to re-model that conceptual understanding, which is of course the most important learning the course should induce.

Bruff also notes that classroom polling can support the opportunity for instructors to ask students for predictions behind the screen of anonymity, which can be useful in certain

contexts. He provides an example of a health and wellness course at another university in which instructors want to draw attention to student perceptions of drinking on campus. The instructors first ask the students how many alcoholic drinks they consumed at their last social occasion, but then they also ask students to predict what they think the responses of their peers will look like. “The differences between the predicted votes and the actual votes,” explains Bruff, “are often surprising to students because it turns out that students are not always as risky as they think they are” (p. 86). The benefit of such a quick prediction exercise is the rich discussion that follows: “This activity can lead to a productive class-wide discussion of social perceptions of risky behavior and the role that marketing, in particular, plays in those perceptions” (p. 86). Such discussions, in other words, can encourage the students to reflect on why their predictions were incorrect—and the role that social media or beer commercials might play in driving their perceptions of their peers’ consumption of alcohol. The potential screen of anonymity provided by clickers obviously can serve a useful purpose when asking students to make predictions based on their own personal behaviors. It also could prove useful anytime you feel students might not want their predictions shared publicly, either because they want something kept private or because they feel they might be embarrassed by making a wildly incorrect prediction in front of their peers (or in front of you).

Prediction–Exposure–Feedback

Even without formal testing or the use of clickers, you can always ask students to make informal, in-class predictions about any course material to which they are about to be exposed. This could happen in almost any discipline, in any type of class.

Scientists know full well how prediction plays a role in the scientific method—in the form of the hypothesis—and likely already ask students to engage in predictive activities in their use of laboratory experiments and reports. But outside of the laboratory, and in other disciplines, instructors can still follow this same basic approach. Get into the habit of asking students to make predictions about new content based on their knowledge from earlier in the semester, from their previous courses, or from their own general knowledge. *How Learning Works* gave two quick examples of this: “Before asking students to read an article from the 1970s, you might ask them what was going on historically at the time that might have informed the author’s perspective. Or when presenting students with a design problem, you might ask them how a famous designer, whose work they know, might have approached the problem.” In these kinds of questions, again, you are requiring students “not only to draw on prior knowledge but also to use it to reason about new knowledge” (Ambrose, Bridges, DiPietro, Lovett, and Norman 2010, p. 33). Ideally, you will both ask for the prediction and give them the opportunity to explain why they made it; doing so will require them to examine their thinking and might help them recognize their knowledge and skill gaps. Even more ideally, after you give them the answer you might ask them to explain why their predictions did or did not hold true.

Earlier in this chapter, I described for you three experiments on learning designed to demonstrate the power of predictions. Imagine that I was describing those experiments for students in a psychology or education course. I describe the setup of the first experiment—with one group of students trying to memorize the word pairs for 13 seconds, and a second group making their guess and then seeing the correct answer for five seconds—and then stop and ask the students to predict the results. I could do this in a generic way, and just invite some students to raise their hands and

speculate, or I could offer specific options and invite students to select the one they think would be correct:

- Memorizers performed 50% better on the test.
- Memorizers performed 10% better on the test.
- The two groups performed about equally.
- Predicters performed 10% better on the test.
- Predicters performed 50% better on the test.

(If all is going well in this chapter, you will remember that the answer is number four.) Students could select the answer they think was correct using polling or simply by raising their hands. After I record the student votes, I might invite a few students to explain their answers, and then show the results. After those results have been revealed, I can use them to make the two points that matter the most: prediction enhanced learning, and it did so by a small but significant margin. Once students have seen the results of this initial experiment, the next two experiments I tell them about will help confirm the knowledge that they have now lodged more firmly in their brains.

If your teaching routine includes describing surveys or experiments for your students, consider varying the typical pattern of describing the setup and then showing the results. Instead describe the setup and ask students to predict the results. After you have shown them the results, invite them to reflect upon the accuracy or inaccuracy of their predictions: Why did they get it wrong or right? What did they learn when the results were revealed?

Closing Predictions

Predictions can close a class as easily as they can open them, but in the case of closing predictions you are pointing students toward the material that they will be reading or studying for homework. Many textbooks include prediction-style questions at the beginning of

a chapter; I suspect that few students read or think about those questions unless they are specifically required to do so. If you have spent a class period finishing up Chapter Five in your textbook, you might end class by asking students to answer one of the prediction questions at the beginning of Chapter Six. When they are sitting down to read Chapter Six that evening or the next day, and spot that question again, they will recall the predictions they made in class, which should (re)-activate their prior knowledge.

You can push this activity one step further by asking students to revisit a closing prediction question in the opening minutes of the next class and reflect on whether or not they got it right and why they did (or didn't). To continue with the example from the previous section, let's assume I had presented the three experiments on prediction and learning in my class period on Monday. But I had reserved a fourth case, one that introduces a new wrinkle to the research, for the end of class. In the closing minutes of the period I describe the setup of this last experiment and ask them to predict the results. But this time I send them away without revealing what happened, and leave them with a teaser: "You'll find the results of this experiment in your reading for Wednesday's class." When students return on Wednesday, I can ask a few students to remind me what they had predicted on Monday, to describe the results they read about, and to account for the difference: What principle or new idea explains the discrepancy between the first three experiments and the fourth one?

PRINCIPLES

Asking students to make predictions requires a very small investment of time, which makes predicting an ideal small teaching activity. The following principles can help guide the creation of prediction activities in your classroom.

Stay Conceptual. Remember that part of the reason predictions work is that they require students to draw up whatever knowledge they might have that will assist them in making their prediction. If you ask them questions that are so specific that they have no prior knowledge to activate, you won't see this benefit. It seems unlikely, for example, that asking students to predict the meaning of a word in a language with which they are totally unfamiliar, in a different alphabet, will offer much learning benefit. Focus prediction activities on the major conceptual material that will maximize their learning in the course.

Provide Fast Feedback. Close the loop on every prediction your students make by providing feedback as immediately as possible. Predictions made at the opening of a class session should be addressed within that class session. Those made at the end, even if they will be answered by the reading or studying that they will do for the next session, should still be reviewed at the opening of that next session. Predictions made in online environments should provide feedback within the same session they are made. Remember that you don't want wrong predictions hanging around in students' heads for very long; the more immediate the correction, the better.

Induce Reflection. As Daniel Willingham has argued, "Memory is the residue of thought" (Willingham 2014, p. 54). In other words, we remember what we spend a little time thinking about. Prediction provides an excellent spur for thought, in that you can ask students to think about why they made their prediction, what actually happened (if the prediction leads to direct observation), and why their prediction was right or wrong. If you are asking students at the beginning of a class to write down a prediction and having a few of them read their predictions aloud, return to those students at the end of class and ask them to explain why they made

those predictions. Students who made correct predictions can be asked to articulate the principle or concept that helped them get it right; students who made incorrect predictions can repair their understanding by articulating the correct ideas.

↳ **SMALL TEACHING QUICK TIPS: PREDICTING**

Predictive activities are the ideal starting point for a small teaching approach, because they are so easy to slot into the opening and closing of a learning unit. These reliable prediction activities give you some practical starting points.

- Open the course with a class brainstorming activity in which you ask students to surface their prior knowledge. Give them time individually or in small groups, and then work as a class to organize that knowledge in ways that will set up the learning to come.
- At the beginning of the class, unit, or course, give students a brief pretest on the material. For example, give an opening-week pretest that is similar in format to the final exam.
- Use classroom polling to break up your course lectures and ask students questions about the next topic you will cover. Pose the question, have them respond with whatever poll technology you are using, and then invite some paired or whole-class discussion of their responses before you move into your explanation.
- When presenting cases, problems, examples, or histories, stop before the conclusion and ask students to predict the outcome. Invite them to reflect afterward on why they got it wrong or right. In other words: pause, predict, ponder.
- Close class by asking students to make predictions about material that will be covered in the next class session.

CONCLUSION

As I was finishing the second edition of this book, an article appeared in a psychology journal which provided another plank of support for the power of prediction, as well as one more reason why prediction has such a positive impact (Brod 2021). The article describes an experiment in which the researchers asked students to predict the scores of a soccer game, then revealed the correct scores to them, and afterward tested their memory of those scores. But they compared the students who engaged in these predictive activities to another group of students who did something slightly different: they were shown the correct scores, and then asked to explain whether those scores matched their expectations about them. In other words, the students in that second group were essentially being asked: If you *had* made a prediction, would it have been correct? As you might expect from the research I have provided throughout this chapter, the students who made the actual predictions had better memory for the soccer games than did the students who only reflected afterward upon how well the scores matched their expectations. The concrete act of making the prediction was the crucial differentiator: they had to use their prior knowledge of soccer to hazard a prediction, and then see the results afterward.

The researchers in this study added one interesting element to their experiment, though. They looked at the pupil dilation of the subjects as the answer was revealed to them. When the subjects who had made predictions saw the correct answers, their pupils dilated, indicating surprise. The researchers thus argue that one of the driving mechanisms behind the learning power of prediction is the quick emotional burst we get from seeing how our prediction turns out. As we shall discuss further in Chapter Eight, emotions can play a key role in enhancing our learning. In this

experiment, the predictions that the subjects made about the soccer games heightened their emotional investment in finding out the scores, and this emotional investment paid dividends in their learning. This finding on the emotional impact of prediction led the researchers to conclude that random guessing doesn't have the same impact as prediction. When I make a random guess, I'm aware of its randomness, and don't make an emotional commitment to it. When I make a prediction, I'm drawing on my prior knowledge to try to understand a novel situation, and as a result I become more emotionally invested in the outcome: I want to know if I was right. It's that emotional investment, the researchers argue, that makes the difference, and that helps lodge the new knowledge firmly in my brain.

Keep this finding in mind as you are engineering predictive activities for your students. If you give them a pretest, encourage them to draw on their previous knowledge to try and get as many correct as possible. If you are asking students to predict something in class with electronic polling, actually give them the time they would need to think about it and make that prediction. The more they commit themselves to their predictions, the more emotion they will feel at the revelation of the correct answer—and the more they are likely to remember it in the future.

Finding meaningful connections



1. How does this idea fit into what I already know?
2. Can this be explained by something else?
3. What does X mean for Y?
4. How can I use this idea to explain Z?

Opening Questions

The quickest method for cultivating retrieval practice in class takes the form of asking questions, either orally or in writing, about material that either you or the students have covered already. So instead of walking into class and providing an overview of what happened in the last class period or reminding students about the larger unit in which this particular class session is embedded, ask them to provide you with that information:

- Before we start, can anyone remind me what we talked about in class on Monday? How about what we were working on last week?
- Before I introduce the third major theory we will explore in the course, what have been the two main theories we have discussed thus far?

Induce Reflection. As Daniel Willingham has argued, “Memory is the residue of thought” (Willingham 2014, p. 54). In other words, we remember what we spend a little time thinking about. Prediction provides an excellent spur for thought, in that you can ask students to think about why they made their prediction, what actually happened (if the prediction leads to direct observation), and why their prediction was right or wrong. If you are asking students at the beginning of a class to write down a prediction and having a few of them read their predictions aloud, return to those students at the end of class and ask them to explain why they made

— 朗文雙解

residue

res·i·due / 'rɛzə,du ; 'rezədju: /noun

1. C,U,a substance that remains on a surface, in a container etc and cannot be removed easily, or that remains after a chemical process 剩餘物，殘留物，渣滓:

[+ from]

•residue from sewage treatment plants 污水處理廠排出的殘餘物

•The flies leave a sticky residue on crops. 蒼蠅在莊稼上留下黏乎乎的分泌物。

•Rinse off any soap residue. 把殘留的肥皂沖掉。

2. C,formal the part of something that is left after the rest has gone or been taken away 剩餘，殘餘:

[+ of]

•The residue of the stock was sold. 剩餘的存貨賣掉了。



can waterfall be used like torrent or deluge in the sense of referring to a lot of?



Yes, the term "waterfall" can be used metaphorically to convey a large quantity or a significant amount of something, similar to the words "torrent" or "deluge." While "waterfall" primarily refers to a natural phenomenon where water flows rapidly and vertically down a steep incline, it can be extended to describe an abundant or overwhelming quantity of objects, events, or information.



For example:

- "We received a waterfall of emails after the announcement."
- "She was bombarded by a waterfall of questions during the press conference."
- "The team faced a waterfall of problems during the project."
- "The internet was flooded with a waterfall of memes after the viral video."

In these contexts, "waterfall" is used metaphorically to emphasize the abundance, intensity, or rapid influx of something.

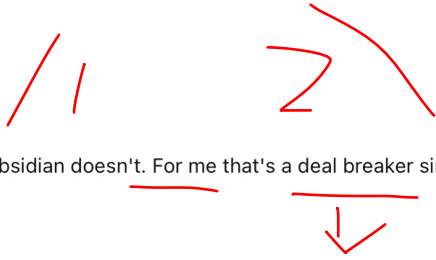


wavestormtrooper • 3 mo. ago

Logseq lets you attach PDF's inline and Obsidian doesn't. For me that's a deal breaker since I attach PDF's in a majority of my notes.

↑ 4 ↓ Reply ↑ Share ...

+ 3 more replies



Library locations



Choose your desired workflow:



Later



Shortlist



Archive

Shortlist: Saved documents go to Later. From there, promote documents you want to focus on into Shortlist.



Inbox



Later



Archive

Triage: Saved documents go to Inbox. From there, triage items you want to defer into Later.



Later



Archive

Classic: Nothing fancy. Classic read-it-later Instapaper or Pocket workflow.

Cancel

Update

Introduce and Chapter1

See the "big picture":

- Why "small teaching"?
- How it's structured?
 - Intro-In Theory (research)-Models (fleshed-out examples)-Principles (stay conceptual)-Quick tips (one-sentence reminder)-Conclusion
- What are these small teachings?
 - Knowledge: Predicting, Retrieving, Interleaving
 - Understanding: Connecting, Practicing, Explaining
 - Inspiration: Belonging, Motivating, Learning
- Expressions worth noting/learning:
 - glaring errors, thicken my research, the spate of articles, scads of research, overshoot, start chipping away, iteration, relish accolades, eke out, merit, fleshed-out, attention-grabbing, spine-tingler, gain much purchase, respond quickly on her feet, corral, differentiator, hazard a prediction
 - The seeds for this book were first planted at..., I come from a family of teachers, the brief entry was the seed that blossomed into XX

b