



# THE SCIENCE OF LEARNING

## A HOW-TO GUIDE FOR TEACHERS

The Learning Agency  
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Up until recently, no one had systematically studied the role of educators and how exactly they promoted learning. Certainly, experts have been theorizing about the practice of instruction for centuries. The Socratic Method dates back to ancient Greece. The apprenticeship model goes back to medieval Europe. The Han Dynasty in China may have pioneered a high-stakes testing approach to schooling--it offered the first civil service exam.

Still, no dedicated researcher had tried in a reliable fashion to measure the difference between a great teacher—and an average one—using robust data like test scores, surveys, and videos. Some years ago, Microsoft founder Bill Gates became fascinated with this fact. He had come across a research paper on the topic of teacher quality—and crowded the document with notes and scribbles. Gates couldn't understand why one of the most basic questions in education had not been answered with modern research tools. "It was mind-blowing how little it had been studied," Gates told a reporter.

Eventually, the world's richest man poured some \$40 million into the research project, and it was massive: Dozens of researchers, thousands of teachers, almost a hundred thousand students. As part of the project, researchers developed a new type of video camera that would give a "panoramic" view of a classroom during a teacher's lesson. Every student in the project filled out surveys. Some 500 people were trained just to evaluate the videos of the teachers.



Known as the MET study, the project lasted two years, and some of the findings were notable. Relatively few teachers in the study pushed students to create their own ideas. Student participation in tasks that required meaning making was rare.

But in many ways, the more interesting results were something else, and it turned out that when it came to teaching, there were two main drivers of student

outcomes, according to Harvard's Ron Ferguson who helped study the data. First, there's what the researchers called "academic press," or the degree to which a teacher pushed a student academically. This was a matter of the educators encouraging students to work hard, to really engage with the material.

The second factor was "academic support," or the degree to which students felt motivated by their teachers. This second factor was about relevance, about a sense of personal connection between the students and the teachers.

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In a way, the conclusions of the MET research wasn't really that surprising. Well before the Gates study, Nobel Laureate Carl Wieman concluded that people should think of teachers as "cognitive coaches." For Wieman, the issue was that the word "teacher" often made people think too much of someone who just hands out information. But that approach to learning gets it all wrong, he argued, and it makes it seem as if learning a topic like physics comes naturally to us.

When I reached out to Wieman, he explained that teachers needed to be more like athletic coaches: They should help students "learn a topic by breaking it down into the key elements of thinking required, then have the students practice that thinking," he told me. At the same time, educators should motivate students to do their best "to carry out this hard work." In other words, people need emotional support.

There's a broader lesson here, and young or old, experienced or amateur, learners need some type of support—and some sort of press—and below I map out some ways for parents, teachers, and managers to help people develop an area of expertise with this sort of focused help.

## SET EXPECTATIONS

There's no getting around it: Learning is hard. Gaining expertise requires cognitive struggle, and learning is often a matter of mental doing. What this means is that people seeking expertise need support and encouragement, and so you should offer lots of praise to people learning something.

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What a great opportunity to learn.”*

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Be sure, however, to focus on process, not outcomes, so people remain motivated. More specifically stop using the word “smart.” People who are told they are “smart” often become complacent, performing under their ability, according to work by Carol Dweck. So praise methods, not performance: Great job working so hard. This is going to be hard. Keep it up.

Teachers—and parents—should also communicate rigorous norms and goals. Tell people what you expect. Even more important, be sure to model this behavior to others and show effective ways to manage struggle and overcome failures. If you make a mistake, tell yourself—and others: What a great opportunity to learn.

## BREAK IT UP

People learn better when learning is delivered in smaller chunks—and over a longer period of time. So encourage people to break up their learning and space it out over time. It's a lot more effective, for instance, for people to study one large pile of flashcards rather than lots of smaller piles of cards because it helps space out their learning. Same with homework: It's far more effective to spread it out over time rather than do it all in one evening.

Employers should also take this approach, too, and instead of one-time training programs, employers should also provide more material for employees on an as-needed basis. So rather than train new employees on

their first day on how to do things like fill out expense reports, put an instructional video on a website for them to reference when they need it. Similarly, employers should try and account for forgetting and help employees revisit key material periodically.

## PROMOTE FOCUS



It's easy to get distracted. It's even easier to get distracted while learning. So create spaces where people can focus on their learning. This means spaces without music or television or loud talking. Many organizations have caught on to this trend and doing away with distracting environments. While Google, for instance, is known for its open floor plan, the tech firm now encourages employees to book a private office if they need to really focus.

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*“Less is often more when it comes to the presentation of ideas.”*

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Likewise, less is often more when it comes to the presentation of ideas. If there's too much information, people's working memory becomes overloaded. So when you're putting together a PowerPoint, don't crowd the slides with graphics. Just have a single message on each slide. Or, if you're giving a talk, make sure you're clear about your core message, repeating it often in case the audience is distracted.

## SUPPORT MISTAKES



For a long time, failure was a dirty word for learners. But today, we know that students need to fail in order to succeed. Part of the reason is that failure helps us understand where our thinking went wrong. Plus, errors often promote learning, helping us to remember.

Teachers, parents, and managers can encourage failure by praising failure. My favorite example is the company SurePayroll, which offers an award for errors. SurePayroll's president, Michael Alter, started the

practice, offering the "Best New Mistake" award, giving a few hundred dollars to the winner each year.

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To support mistakes, people should not give answers to students too quickly. Let students struggle. As Nobel Prize winner Carl Wieman argues, if students land an answer too early, they don't gain from making errors. At the same time, make sure to support the emotional side of learning and offer people emotional support when they fail.

## USE ANALOGIES

Analogies often spark memories of IQ tests (Nest is to bird, as doghouse is to \_\_\_\_\_). But analogies help us often serves as true mother of invention. Johannes Gutenberg invented the printing press after seeing a wine press, while Twitter is half SMS, half social media.



People can use analogies to help explain new ideas. Smart marketing companies know this, and they are famous for using analogies to introduce new products. The insurance firm State Farm, for instance, has long relied on the jingle: Like a Good Neighbor, State Farm is There.

Analogies can also promote creativity. The phrase Uber but for ... is a great example, and people have used the car sharing company to come up with various new startups. The company Blue Apron has presented itself as the Uber for high-end cooking. The dry-cleaning company DRYV has been described as Uber but for dry

cleaning.

## PROMOTE REVIEW

We're all overconfident. Sometimes this is a good thing. No one would lead a company—or keep up a blog—without some streak of brashness. But when it comes to learning, we often think that we know more than we do, and teachers, managers, and parents should help others review what they've learned.

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*“When it comes to learning, we often think that we know more than we do...”*

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For an example, the next time that a person— your boss, your wife, a friend—gives you a set of detailed, multi-step instructions, take time to verbally repeat back the instructions. By reciting everything back, you take steps to create that knowledge, and you'll be far more likely to remember the information.

## PRACTICE WHAT YOU PREACH: POP QUIZ

Quizzing is one of the most effective ways to retain information. Here is a short, low-stakes pop quiz on some of the lessons that we've covered in this guide, with answers to follow.

1. True or false: Learning requires mistakes.
  
2. True or false: Learners shouldn't set goals.
  
3. True or false: Learning should be spaced out over time.
  
4. A parent praises a student for solving a math problem. Which praise will be the most effective in motivating the student to work through difficult problems in the future?
  - A. You must be really smart.
  
  - B. You must have worked really hard.
  
  - C. You've got a brain for math.
  
  - D. Math must come easy to you.



*Note: Almost all of the material in here has been published before, either in Learn Better: Mastering the Skills for Success in Life, Business, and School, or, How to Become an Expert in Just About Anything, or in other articles by Ulrich Boser. For citations and other notes, please see the full book.*

(Answers to quiz: 1. True; 2. False; 3. True; 4. B)