

JOSÉ ANTONIO BOWEN · C. EDWARD WATSON

TEACHING NAKED

TECHNIQUES

A PRACTICAL GUIDE TO DESIGNING BETTER CLASSES

Teaching Naked Techniques

A Practical Guide to Designing Better Classes

**José Antonio Bowen
and C. Edward Watson**

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Introduction

Designing for the Brain in the Body

THIS BOOK INVESTIGATES how we might apply new technology and research on how the brain learns to redesign courses and classrooms. Decades of research have brought an explosion of knowledge about how human evolution shaped the way we process, think, and remember. That research informs this book, but the focus here is on practical and discipline-specific applications for faculty. At the same time that psychology and research have given us new insights into student learning, students now have much more to learn and new technologies that help, or inhibit, how they learn. We are already in a new learning economy, where, thanks to this same explosion of knowledge creation and technology, most of what students will need to learn, they will need to learn *after* they leave our classrooms. What we know in our disciplines will remain important, but what we know about student learning and development will also grow in importance. The future belongs to self-regulating, lifelong learners, and we need to know how to create them.

As faculty, we of course have spent a lot of time in school, and we assume that gives us some insight into how people learn. Sadly, the opposite is probably true. We may have understood the value of paying attention even when bored, long sessions of single focus without distraction, distributed repetition, the futility of cramming, discovering why the professor assigned the reading, the importance of rewriting notes, and probably naps. All of these are now proven learning enhancers, but none of them are obvious. If we are to turn students into lifelong learners (by far, the most important outcome of college in the learning economy and the Internet age), we need to be explicit in designing environments that help students learn for themselves.

Terry Doyle (2008, p. 25) sums it up this way: “The one who does the work, does the learning.” That does not mean teachers only need to put content out there and let students work; if that is all you do, the Internet does it better. Rather, it means that *the value of the teacher is in the way he or she can stimulate good behaviors in students: pedagogy is a design problem*. The fitness coach does not do our exercise for us but still provides enormous value. More exercise equipment will not increase your fitness, in the same way that more content will not increase your learning (faculty being the exception). Normal learners need a teacher who understands their anxieties and what motivates them and can then create structures that will allow them to succeed.

Learning Behaviors: The Brain in the Body

Sleep, water, exercise, eating (diet), and time (SWEET) plus a few study habits may matter as much as our pedagogical methods or classroom technology. We know a lot about the good behaviors of learning, and we can learn the basic science with excellent books from James Zull (*The Art of Changing the Brain: Enriching the Practice of Teaching by Exploring the Biology of Learning*, 2002, and *From Brain to Mind: Using Neuroscience to Guide Change in Education*, 2011) and Brown, Roediger, and McDaniel (*Make It Stick: The Science of Successful Learning*, 2014). Terry Doyle and Todd Zakrajsek’s *The New Science of Learning: How to Learn in Harmony with Your Brain* (2013) has even turned this research into a practical manual for students, but how do we best apply this research to redesign classrooms and colleges? (See Chapter 12 in this book.)

Kuh, Kinzie, Schuh, and Whitt (2005) and Chambliss and Takacs (2014) have identified a number of high-impact pedagogical and institutional practices, many of them small or low-cost changes, that have a disproportionate impact on student learning. Understanding that our brains are encased in physical bodies and that stable blood glucose and protein are essential for connecting brain cells provides us with even more ways to improve learning. We know, for example, that most of us are mildly dehydrated when we wake up, but the brain needs plenty of water for better learning. Perhaps two tall glasses of water before the first morning class is another high-impact practice?

Dement and Vaughan (1999) helped us learn about sleep deficits and how hard they are to detect, and additional studies have provided insights that likely have ramifications for learning. As an example, we now know

that when we go two straight weeks with only 6 hours of sleep a night, we are actually as impaired as those who had not slept for the last 48 hours (Van Dongen, Maislen, Mullington, & Dinges, 2003). Without that last 2 hours of sleep, we just write over the short-term memory the next day and remember very little from the previous day. We have known for decades that adults need 7.5 to 9.0 hours a night of sleep, but we now know that our memories move from the hippocampus (short-term storage) to the neocortex (long-term memory) mostly in the last 2 hours of the night (Walker, Stickgold, Alsop, Gaab, & Schlaug, 2005). Sleeping with the smell of roses (and perhaps other pleasant smells) after studying improves this process (Rasch, Buchel, Gais, & Born, 2007), as does studying just before bed or taking a break after studying (Dewar, Alber, Butler, Cowan, & Della Sala, 2012). Similarly, high-performance athletes and musicians are much more likely to interleave practice with breaks. We have also learned that the brain prioritizes what we think is important: students who studied new material before bed and knew it was going to be on a test remembered substantially more than those told they would not be tested on the material (Wilhelm et al., 2011). Is there any way we can apply that knowledge to how we design our courses?

Research on the learning benefits of sleep and naps has exploded since about 2000 (“Napping May Not,” 2009). A short nap, 8 hours after you wake up, is much better at helping you pay attention than an extra 20 to 30 minutes of sleep each night (Maas & Robbins, 2011). Short naps (20–30 minutes) and breaks immediately after learning also help stabilize memory (Doyle & Zakrajsek, 2013). We know that breaks and naps are important for processing and that the brain also connects by proximity, especially time. This suggests that back-to-back classes are a bad idea for most learners. Would it be a good idea for higher education to reexamine its course grid?

Research on learning and movement should also have profound implications for how we design our campuses and classrooms. Our brain evolved to learn while in motion, and 80% of the brain’s neurons are located in the cerebellum, the large structure on the back dedicated to motor coordination. Our survival is now less dependent on the way we move through our environment, and a growing body of research investigates the relationship between our increasingly sedentary lifestyles and depression. In *The Case for Working With Your Hands*, Matthew Crawford (2011) makes a compelling argument that the massive increase in the reporting of depression—10 times more at the end of the 20th century than at the beginning (Blakeslee, 2004)—and the even more massive increase in the use of chemical

antidepressants—up 400% between 1988 and 2008 (Kuehn, 2011)—is related to less challenging contexts for our brains. Manual labor is not necessarily less cerebral, and the mental health benefits of chores and daily activity have long been recognized. Gardening or knitting was prescribed for women with anxiety in the 19th century (Lambert, 2015), but new studies confirm that knitting and crafting increase cognitive functioning, reduce stress, and increase dopamine production (Riley, Corkhill, & Morris, 2013). New depression treatments that use coordinated movement are 50% more effective than treatment with antidepressants alone (Lambert, 2015). Handwriting and manual note taking also seem to have benefits (Mueller & Oppenheimer, 2014), and given that so much of our motor coordination involves our hands, this should be no surprise. Typing also involves the hands, so it may be that we can eventually find even more productive ways to take notes with technology, but it is unlikely that “hands-free” learning will ever be optimal.

We have long known that students prefer learning by doing. But now we also understand that doing means movement (many of the techniques in Chapter 7 get students moving). Mild exercise creates the protein BDNF, which collects in pools near brain synapses to stimulate every aspect of learning, which is mostly about growing connections between nerve cells (Ratey, 2013). Mild movement, like walking, sitting on a balance ball, or working at a stationary bike, all seem to improve learning. Very recent research suggests that exercising four hours after learning also improves retention of that content (Van Dongen, Kersten, Wagner, Morris, & Fernández, 2016).

We can now finally put to rest the false notion that some people are primarily audio, visual, or kinesthetic learners (Pashler, McDaniel, Rohrer, & Bjork, 2008). We all learn better and remember more when the senses are combined (Moreno & Mayer, 2007; Shams & Seitz, 2008), and we all learn more and more quickly from visuals (Medina, 2014). It is no accident that when we understand something, we say “I see.” “The brain’s ability to visualize is arguably the most significant aspect of cognition” (Zull, 2002, p. 138), which is why translating ideas into graphs and pictures works as an effective study technique. Reading is the slowest way to get information (Dehaene, 2009), but faculty were often the ones who figured out that annotations (not underlining), elaborations, and lack of distractions help enormously (Brown, Roediger, & McDaniel, 2014). Elaborations are efficient because they retrieve, reuse, and restore, so visual elaborations (e.g., concept maps) are another powerful study tool (Novak & Cañas, 2008: both are discussed in Chapter 6).

Ultimately, the nature of your desired learning outcomes should largely dictate the modality you might choose to use as you teach (see Chapter 11). For instance, imagine the two of us had never played tennis before, but Eddie was given a week to review a tennis-for-beginners book and José was given an hour's lesson with a tennis pro. All other things being equal, who would you think would likely win their first tennis match? So if you want your students to be able to perform dissections of animals, reading about how to do it or watching video demonstrations are not the most effective approaches to helping them achieve that outcome. Having scalpel in hand in front of a real specimen with some guidance and feedback along the way is the best choice of strategy.

Focus and Motivation

A significant body of evidence shows that humans do not possess the cognitive, behavioral, or cortical structures to effectively multitask (Watson, Terry, & Doolittle, 2012). We are, however, really good at doing one thing at a time. For most, multitasking is really just switching between tasks (Medina, 2014), but it doesn't appear we are good at that either (Strayer, Cooper, Turrill, Coleman, & Hopman, 2015). So one question, then, is this: Can we structure learning environments and assignments to help students study in longer, more engaged blocks? How do we encourage students to invest the appropriate amount of time in preparation for class, for instance (see Chapter 6)? Investment is a key concept. Emotions are also linked to memory and learning (Immordino-Yang, 2015), so emotional investment (what we call "entry point" in Chapter 2) is key. Connecting these concepts, it's not surprising that people remember a concept that is attached to a dramatic image (Perrin et al., 2012)

We know students learn more when they pay attention, but note that phrase: "pay attention." Focus costs us something, and Langer (1989) notes how easily we can overfocus. When we "pay attention," we give up something else (that might be more interesting). More interesting and less stressful teachers and classrooms can help (discussed in Chapter 7). Sensory information is sent simultaneously to two parts of the brain: the sensory cortex and the amygdala, our emotional control center. Yes, everything we want our students to learn is also checked for potential threat (Zull, 2002). When we perceive something as dangerous, we react instinctively, shutting down our cognitive processors. Emotional engagement, low stress, and feeling safe and supported are all important for learning (and feature

in the techniques discussed in Chapter 4). While colleges often talk about “disturbing students,” note that too much disruption shuts down learning. The same is true for the balance between too easy and too hard. We need to get more students into the “pleasantly frustrating” zone (see Chapters 8 and 11), but ultimately, we all have to learn something boring at some point in our lives (boredom is the opposite of “pleasantly frustrating”; it happens when something is not personally engaging and perceived as trivial or impossible). Those who do the work, who find a way to engage, are the ones who learn. Paraphrasing Richard Bach (1977), learning success requires sacrificing boredom.

People who understand and can use delayed gratification do better in almost every aspect of life (Mischel, Shoda, & Rodriguez, 1989), and we also now understand that our belief in our ability to learn—our mindset—is equally critical in determining what we can learn (Dweck, 2007). We’ve learned that praising hard work instead of talent or ability helps (Dweck, 2007), but we’ve had difficulty figuring out how to get students to push through the boring bits (Duckworth, 2016). Fitness coaches understand this problem.

What a fitness coach knows about your body is key. For instance, holding stretches for less than 30 seconds does not allow your muscles time to reap the full benefit. A good fitness coach also reminds you that hard work is the only real solution to better fitness. Similarly, teachers should be able to tell you about various ways in which your brain learns best. In general, students who can work even when they are bored and who understand how to pay attention do better. It has been noted that mind wandering shows a failure of executive control (Schacter & Szpunar, 2015; Seli, Smallwood, Cheyne, & Smilek, 2015), but we shouldn’t be surprised by this “failure” in many of our students. Full brain maturation doesn’t occur for most humans until around the age of 25 (Aamodt & Wang, 2011). It’s not a random choice that most car rental companies require renters to be at least 25 years old. This doesn’t mean that it’s impossible to control mind wandering. Langer (1997) and, more recently, Barbezat and Bush (2014) suggest that mind wandering can be harnessed through mindfulness practices. Certainly, strategies that foster self-regulation can help students work through bouts of boredom and increase appropriate focus.

Mischel and Ayduk (2004) now believe that the key to delayed gratification in five-year-olds, and perhaps in all of us, is distraction. When we know we need to wait, using strategies that make the time go faster seems to help. That appears connected to the most recent research that having a higher purpose or mission (or helping students remember why they

are working so hard) greatly improves persistence (Yeager et al., 2014). Reminding students not only that learning is work but that this work is directly connected to their own personal goals helps. The more transcendent the goal, the better. Students will work because they need to pass your class, but they will work harder if they understand it will save the lives of their patients or help them get a job later. It is why fitness trainers start by getting to know you and not first watching you sweat.

Getting students to enjoy learning for its own sake is probably another mistake based (again) on faculty using themselves as models. Learning for pleasure, especially in formalized classroom settings, is perhaps not as normal as we might assume. Human evolution suggests that we learn what is most important to us, and our brains prioritize constantly what we should retain and what we can discard. Asking students to “find something interesting” in the reading helps recall; they may not find it pleasurable, but that’s okay. Fitness coaches like to work out, often obsessively, and they recognize that they themselves probably do not need a motivation coach. Their clients have come precisely because they do not like to work out. In many ways, that’s an apt metaphor for you and your students.

Our job as faculty is to understand how the brain learns, what motivates students, and how to create environments that encourage good learning behaviors on the part of students. We need then to assess progress, provide feedback, and encourage more work. It is a bit like helping people use a gym, except that our design issue is largely psychological instead of physical. Faculty are cognitive coaches.

Learning and Technology

A fitness coach understands the human body and the individual subject, but also the equipment in the gym. Technology is bringing new tools and new competition to higher education, but it is also changing the basic rules about how we operate as human beings: the meaning of *friends* has changed forever. Technology or equipment, of course, is only a tool, not an educational strategy. While our use of technology will surely increase, our goal remains more learning. For this, colleges and universities will need to design much better environments (see Chapter 12) that include vastly more thorough understandings of both how technology works and how learning works.

Internet technologies have changed our relationship with knowledge. While most of us remember a not-so-distant past of knowledge scarcity (where the simple arrival on a campus increased our access to knowledge).

Current students have no concept of this. The world is now knowledge rich, and students can access more information from their phone than in any college library. The Internet is overloaded with data. I can, for example, get information on every flight every day to every place, but the app on my phone limits that information to what is relevant and useful today: Is my flight on time, and how long will it take me to get to the airport given current traffic conditions? College should be like an app for the mind.

As faculty, if we are primarily concerned with transmitting content, our value will continue to decrease. The Internet contains a much broader selection of lectures, demonstrations, animations, and examples, on more subjects, in more languages, and with a greater variety of approaches, methods, and pedagogies, than any professor, department, or even entire university could provide. If, however, we are more concerned with faculty-student interaction; the design and sequence of learning experiences; the application, analysis, and synthesis of information; the motivation of students; and especially the increasing complexity of student mental models, then the value of what we do will increase.

While all colleges talk about the importance of critical thinking, higher education is largely structured around the delivery of content. The way we furnish classrooms, structure curriculum, train future professors, organize syllabi, and assess student learning prioritizes current disciplinary knowledge. All of these are holdovers from a time when opportunities for learning were scarce, but in the future, there will only be more things and more ways to learn. Access to content and courses will be cheap and plentiful. As we know already from the early massive open online courses (MOOCs), knowing how to learn new content (and, more important, how to integrate new ideas) is a necessary prerequisite for MOOC success. The point of college is increasingly to prepare the mind for the unknown, to prepare students to be lifelong learners in diverse contexts.

While knowledge is required for thought, content is a means and not the end. Our real goal is to improve how students process and integrate new information. We want to change them. While what we have to teach them may get them a first job, it will not—on its own—get them a second job that may not yet even exist. We want our students to be able to learn new things, analyze new knowledge, integrate it into their thinking, and occasionally change their minds when necessary. Employers say they want employees who can solve complex problems with people who are different from them (Hart Research Associates, 2013). This seems entirely in harmony with what colleges say we do. The disconnect is that while we

hope to accomplish these two things simultaneously, we often spend more time on content than on critical thinking. We, in higher education, tend to accuse employers of not really meaning what they say and overvaluing certain majors or graduates from elite schools. Would this still be the case if we could really deliver what employers say they want? Companies like Google say they are no longer going to accept these proxies (content training or admission standards) in place of creative and critical abilities (which they will measure themselves). What if we could demonstrate that our liberal arts graduates have these skills?

Technology can be a partner in changing this. The technology that makes knowledge so easily accessible has also made the ability to analyze that information more important. Furthermore, with greater access to content now freely available, we should have more time in the classroom for the pedagogy of critical thinking. Teaching critical thinking is hard and labor intensive; technology has also made course design and pedagogy more important. If you think of a syllabus or a course as being a list of topics or content to be mastered, you are doing only half of your job, and that is the part of the job that is being devalued.

The good news is that the greatest value of a physical university will remain its face-to-face (naked) interaction between faculty and students. The first role of technology therefore is to create more time and more opportunities for teaching naked. At a basic level, new technology can increase student preparation and engagement between classes and create more time for the (naked) in-class dialogue that makes the campus experience worth the extra money it will always cost to deliver. The most important benefits to using technology occur *outside* the classroom.

Pedagogy as Design

Education is ultimately a design problem: the goal is to create structures and processes that will encourage students to engage in the behaviors that lead to learning. In the end, students must do the work, but that does not mean that we are simply content providers. Instruction is not teaching; it is designing.

We often think of design as just “style,” but designers also frame and solve problems, assess sequence, integrate user needs, anticipate extremes, and improve systems. Design thinking and techniques are now being applied in everything from medicine to public policy. Education is indeed a design problem. While students are the “products” of education, they

are also undeniably the “users,” and we are designing systems that will frame their goals, guide them, and anticipate problems along the ways. In truth, technology has increased the need for teachers to think of pedagogy as design.

Using more technology increases your credibility with students but by itself does not increase learning. Students are often quite able to use the technology that they find useful or entertaining, but they are not proficient in using technology to access information, and we especially need to think much more carefully about how they process and integrate what they access.

Dee Fink (2013) has developed an integrated model of course design that connects learning outcomes, activities, and feedback to create significant learning experiences. Technology has given us more options for how we sequence these activities, created more options for feedback and support, and made class time (the most expensive and least scalable piece) even more precious.

“Inverting” or “flipping” assumes there are two parts to be exchanged, but using Fink’s model, it becomes clear that teaching naked also needs to

FIGURE I.1

A Thumbnail Summary of the Essentials of Human Learning and the Teaching Naked Design Process

The Science	The Student Experience	The Teaching Naked Design Process
Concrete and personal (matters to me, examples)	Motivation	Instructions and entry point (concrete and personal)
Knowledge is necessary (but not sufficient)	Exposure (Content)	Content for first exposure (read/watch/do)
Retrieval and self-testing (online exams, games)	Recall	Exam to evaluate (retrieval)
Elaboration (connections, analogies, writing)	Elaboration	Writing to reflect (elaborate, contextualize)
Abstract (extracting rules, larger context, mental models)	Reflection	Cognitive wrappers to self-regulate (abstract)
Failure (add difficulty, attempts before solutions, feedback)	Complication	Class to challenge (failure, complicate)
Interleaving (varied practice, space out practice)	Reflection	E-Communication to reinforce (connections, spacing)

Source for Science: Brown, Roediger, and McDaniel (2014).

be thought of as a cycle, looking more broadly at the choices of sequence and design and at how technology expands the opportunities for interactivity. Using new communication technologies, rethinking our assignments, and creating online quizzes and games can ensure that students finally come prepared to class for the more challenging activities and interactions that most spark the critical thinking and change of mental models we seek.

Our design processes were equally influenced by the new research on how the brain learns and by key ideas from *Make It Stick: The Science of Successful Learning* (Brown et al., 2014) and by thinking about how these track with the student experience. The science and how we translated this into pedagogy are summarized in Figure I.1. Learning is more likely to stick when it is:

- *Concrete and personal.* Our brains prioritize. We are less likely to be bored or to prioritize other learning when we understand how this learning matters specifically to us. We like examples, but they help only if the examples are relevant to us.
- *Knowledge is necessary.* All colleges say they teach critical thinking, but this is not a purely abstract technique: we need to think about *something*. At the same time, rote memorization neither sticks nor advances thinking because it is often disconnected from existing schemas and mental models. Bloom was right: when we analyze, apply, and critique new knowledge, it is both more likely to stick and to change us.
- *Retrieval and self-testing.* Retrieval is essential to learning, and the more the better. We have become confused: tests are actually a great learning tool (and not just an assessment tool). The problem with tests are the stakes: high stakes lower performance. Game designers understand this and provide lots and lots of low-stakes retrieval (video games are really a series of microtests with continuous variation and addition of new material after mastery).
- *Elaboration.* We learn by connecting and comparing new information to what we already know. Translating content into your own words and explaining it to others in different contexts and with new analogies is much more effective than simple repetition. Highlighting creates false fluency. Exposure and rereading make things look familiar, but that is not deep learning. Writing, for example, is an effective way to process and elaborate.
- *Abstract.* Extracting the larger rules and concepts and putting them into a wider context is equally important. If we want learning to improve the complexity of students' mental models, we need to make sure they are working on their own to abstract and contextualize.