

Introduction



Once upon a time there was a mindless little girl named Little Red Riding Hood. One day, when she went to visit her ailing grandmother, she was greeted by a wolf dressed in her grandmother's nightclothes. "What big eyes you have, Grandma," she exclaimed, clueless as ever, although she had seen her grandmother's eyes countless times before. "What big ears you have, Grandma," she said, although it was unlikely that they would have changed since her last visit. "What a deep voice you have, Grandma," she said, still oblivious to the shaggy imposter beneath the familiar lacy nightcap. "What big teeth you have," she said, too late, alas, to begin paying attention.

Certain myths and fairy tales help advance a culture by passing on a profound and complex wisdom to succeeding generations. Others, however, deserve to be questioned. This book

is about seven pervasive myths, or mindsets, that undermine the process of learning and how we can avoid their debilitating effects in a wide variety of settings.

1. The basics must be learned so well that they become second nature.
2. Paying attention means staying focused on one thing at a time.
3. Delaying gratification is important.
4. Rote memorization is necessary in education.
5. Forgetting is a problem.
6. Intelligence is knowing “what’s out there.”
7. There are right and wrong answers.

These myths undermine true learning. They stifle our creativity, silence our questions, and diminish our self-esteem. Throughout this book we will examine them, sometimes through experiments carried out at Harvard and elsewhere and sometimes with insight drawn from fairy tales and folktales from around the world. The process of overturning these myths leads to certain questions about the nature of intelligence. In the last two chapters we will explore these questions and the ways in which our view of intelligence may support inhibiting mindsets.

The ideas offered here to loosen the grip of these debilitating myths are very simple. Their fundamental simplicity points to yet another inhibiting myth: that only a massive overhaul can give us a more effective educational system.

We can change school curricula, change standards for testing students and teachers, increase parent and community

involvement in the process of education, and increase the budget for education so that more students can become part of the computer age. None of these measures alone will make enough difference unless students are given the opportunity to learn more mindfully. With such opportunity, some of these expensive measures might well become unnecessary.

Wherever learning takes place—in school, on the job, in the home—these myths are also at work and the opportunity for mindful learning is present. Whether the learning is practical or theoretical, personal or interpersonal; whether it involves abstract concepts, such as physics, or concrete skills, such as how to play a sport, the way the information is learned will determine how, why, and when it is used. The succeeding chapters explore the way each of these myths locks us into rigid habits of learning and offer keys to a more flexible and productive approach.

This book takes more of a “why-to” than a “how-to” approach. Nevertheless, the examples and experiments described implicitly suggest ways to learn mindfully. These are intended to guide our choices and to be adapted to each unique context, rather than to be followed mindlessly.

Not only do we as individuals get locked into single-minded views, but we also reinforce these views for each other until the culture itself suffers the same mindlessness. There is an awareness of this in science. Scientists proceed along a path gathering data that builds on accepted wisdom. At some point someone turns everyone’s attention to a very different view of the previously acknowledged truth. This phenomenon happens

frequently enough that scientists are generally not surprised by what is called a paradigm shift. In a recent *New York Times*¹ article psychologist Dean Radin described four stages of adopting ideas: "The first is, 1. 'It's impossible.' 2. 'Maybe it's possible, but it's weak and uninteresting.' 3. 'It is true and I told you so.' 4. 'I thought of it first.'" I would add a fifth stage, "We always knew that. How could it be otherwise?"

The term *mindful learning* is used here in a very specific way, drawn from the concept of mindfulness that I defined in an earlier book by that name.² A mindful approach to any activity has three characteristics: the continuous creation of new categories; openness to new information; and an implicit awareness of more than one perspective. Mindlessness, in contrast, is characterized by an entrapment in old categories; by automatic behavior that precludes attending to new signals; and by action that operates from a single perspective. Being mindless, colloquially speaking, is like being on automatic pilot. In *Mindfulness*, I described the benefits of a mindful approach for our psychological and physical well-being. For instance, elderly adults given mindfulness treatments were shown to live longer than their peers who were not given such treatments. In this book I use the concept of mindfulness as a lens through which to explore its importance in the world I know best, teaching and learning.

In many of my classes students are quick to point out examples of their own and others' mindlessness. The examples often come from the texts and research under discussion. When I'm the perpetrator of this mindlessness, I examine it

closely. Why didn't I reconsider the old information when presenting it in a new context? Why did I trot out the received wisdom on this particular topic? Such puzzles keep sending me back to investigate the way I learned the information in the first place.

Each year, in a course I teach on decision making and perceived control, to bounce my students out of their habitual state of mind I ask them if one can prevent pregnancy with a nasal spray. They laugh or at least grimace at this obvious absurdity. Then I show them what by now is an old newspaper article with the headline "Nasal spray as a new means of birth control," and their interest picks up. Their first response is not unusual. When faced with something that hasn't been done before, people frequently express the belief that it can't be done. All progress, of course, depends on questioning that belief. *Everything is the same until it is not*. If instead of asking, "Is it possible to prevent pregnancy with a nasal spray?" we ask, "How could we use a nasal spray as a method of birth control?" we set off on a different search, in a different frame of mind. Instead of dismissing the question as foolish, we start thinking about how to get from the nose to the egg and sperm. Once we generate possible ways of doing something, even if they are low-probability bets, the perception of a solution's being possible increases enormously. (I may have to come up with a new puzzle next semester, since recent research on pheromones and their influence on hormone levels has made a nasal contraceptive seem less incredible.)

Although with a range of ability and accomplishments, the students I meet are among the brightest imaginable. Yet even the very best can be mindless, insecure about what they know. Ironically, many are unhappy with an educational experience that has only rewarded them. Their dissatisfaction may result from certain of these debilitating myths, such as that expressed in "Study now, play later." Throughout their careers, these gifted students have learned to delay gratification. Why is study itself not gratifying? If not, how could it be? If rote memory is a tedious way to prepare for an exam, is there a more effective and more gratifying way?

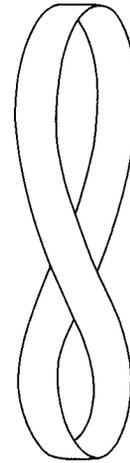
These students have all been tested, tried, and found to be worthy of extreme praise. What does it mean when such an intelligent person gives a wrong answer? Is the wrong answer a lapse, an indication of stupidity? Or does the "wrong" answer merit consideration? And if for these students, why not for all students?

In trying to answer these questions I will not limit the notion of learning to the classroom. In our so-called learning society the mindsets that hobble us can be found all over: from music lessons to investment analysis; from television viewing to psychotherapy. As we will see, our attitudes toward aging and advertising, our approach to decisions, and even our preferences in art, sports, or entertainment all depend on the views we hold about the nature of learning. As an example, a very intelligent friend of mine, successful in business, was told, to her dismay, that she had an attention problem. I was surprised. I burrowed into the vast literature on attention deficit hyperactivity dis-

order (ADHD), read the symptoms of the disorder, and was even more surprised to see that I have it as well. Or do I? What exactly does it mean to pay attention? We have to answer this question before we can sensibly talk about a deficit or disability.

From questions such as these I was drawn into a more general investigation of education and how we learn. By observation and experiment, I have come to see how seven particular myths make it hard to learn and in the process, make it hard to teach.

When Practice Makes Imperfect



When he arrived on the planet he respectfully saluted the lamplighter.

“Good morning. Why have you just put out your lamp?”

“These are the instructions,” replied the lamplighter. “Good morning.”

“What are the instructions?”

“The instructions are that I put out my lamp. Good evening.”

And he lighted his lamp again.

“But why have you just lighted it again?”

“These are the instructions,” replied the lamplighter.

“I do not understand,” said the little prince.

“There is nothing to understand,” said the lamplighter. “Instructions are instructions. Good morning.”

And he put out his lamp.

Then he mopped his forehead with a handkerchief decorated with red squares.

"I follow a terrible profession. In the old days it was reasonable. I put the lamp out in the morning and in the evening I lighted it again. I had the rest of the day for relaxation and the rest of the night for sleep."

"And the instructions have been changed since that time?"

"The instructions have not been changed," said the lamplighter. "That is the tragedy! From year to year the planet has turned more rapidly and the orders have not been changed!"

The Little Prince

ANTOINE DE SAINT-EXUPÉRY¹

Day after day the celestial lamplighter performed his well-practiced task. For him by now it was second nature. The planet, however, like the rest of the world, kept on changing. The routine stayed fixed, while the context changed.

One of the most cherished myths in education or any kind of training is that in order to learn a skill one must practice it to the point of doing it without thinking. Whether I ask colleagues concerned with higher education, parents of young children, or students themselves, everyone seems to agree on this approach to what are called the basics. Whether it is learning how to play baseball, drive, or teach, the advice is the same: practice the basics until they become second nature. I think this is the wrong way to start.

OVERLEARNED SKILLS

Before explaining this last statement, let me give an example of just one context for each of the skills I mentioned that might lead one to question this faith in practicing the basics.

As a child in summer camp I was taught to practice holding a baseball bat a particular way. The idea was to do so without thinking so that I could attend to other aspects of the game, such as the particular pitch I was trying to hit. Now, after years of lifting weights imperfectly, my right arm is stronger than my left. Should I hold the bat the same way in spite of this difference? Should everyone hold a bat the same way?

Because my driving skills have been overlearned, I flip my turn signal on automatically before making a turn. Now, suppose that I'm on an icy road about to make a turn, but the car is somewhat out of control. Wouldn't turning on the signal in the same old way misguide the car behind me by seeming to indicate that the situation is well in hand? Would use of the flashing light be more appropriate in this context? Recently I gave a talk in New Mexico. I was driven from the airport to the hotel across a desert, without a car in sight for miles and miles. At each turn, the driver dutifully signaled.

Imagine overlearning the basics of driving in the United States and then taking a vacation in London, where people drive on the left side of the road. The car in front of you swerves out of control and you must react quickly. Do you slip back to old habits or avoid an accident by responding to what

the current situation demands? It is interesting to consider that emergencies may often be the result of actions taken in response to previous training rather than in response to present considerations.

One of the “basic skills” of teachers, and all lecturers, is the ability to take a large quantity of information and present it in bite-size pieces to students. For those of us who teach, reducing and organizing information becomes second nature. How often do we, so practiced in how to prepare information for a lecture, continue to present a prepared lesson without noticing that the class is no longer paying attention? Presenting all the prepared content too often overtakes the goal of teaching.

For students, note-taking skills can be overlearned, practiced as second nature. Many of us have had the experience of turning to our notes and finding that we don't have the vaguest idea what they mean.

Traveling makes us particularly aware of rigidities. In several Asian countries drivers drive on the left side of the road, and pedestrians on the busy sidewalks follow the same pattern as cars, staying to the right or left accordingly. The frequency with which I came close to walking into people when traveling in Asia made clear to me that even a simple exercise, such as walking on the right, if originally learned mindlessly, may be hard to change. Each time I traveled to a different country, the rules changed, and my awkwardness increased.

In an art gallery in Hanoi, I encountered the results of basic training in Western customs of politeness. The gallery owner

offered me a seat from which to view the paintings. I politely refused. She offered it to me three more times. It appeared that her lesson did not include what to do if the customer preferred to stand. She took her cues as to what to do from her lesson, and not from the situation.

In Singapore, on my way to Chinatown, I asked the taxi driver how large the Chinese population was. He answered, “Seventy-six percent of the country is Chinese.” I said, “Are you sure it's not 77 percent?” He laughed, although I think many would not have been sure what I was getting at. The government had published a report saying that 76 percent of the population was Chinese, and for many that remained fact without any awareness that births, deaths, emigrations, or immigrations could change the number at any moment. This is the way most of us have been taught to take in information—as though it is true irrespective of new contexts.

When we drill ourselves in a certain skill so that it becomes second nature, does this lead to performing the skill mindlessly? Do we set limits on ourselves by practicing to the point of overlearning? When we approach a new skill, whether as adults or children, it is, by definition, a time when we know the least about it. Does it make sense to freeze our understanding of the skill before we try it out in different contexts and, at various stages, adjust it to our own strengths and experiences? Does it make sense to stick to what we first learned when that learning occurred when we were most naive? When we first learn a skill, we necessarily attend to each individual step. If we overlearn the drill, we essentially

lose sight of the individual components and we find it hard to make small adjustments.

Learning the basics in a rote, unthinking manner almost ensures mediocrity. At the least, it deprives learners of maximizing their own potential for more effective performance and, as we will see in Chapter 3, for enjoyment of the activity. Consider tennis. At tennis camp I was taught exactly how to hold my racket and toss the ball when serving. We were all taught the same way. When I later watched the U.S. Open, I noticed that none of the top players served the way I was taught, and, more important, each of them served slightly differently. Most of us are not taught our skills, whether academic, athletic, or artistic, by the real experts. The rules we are given to practice are based on generally accepted truths about how to perform the task and not on our individual abilities. If we mindlessly practice these skills, we are not likely to surpass our teachers. Even if we are fortunate enough to be shown how to do something by a true expert, mindless practice keeps the activity from becoming our own. If I try to serve exactly as Martina Navratilova serves, will I be as good as she (apart from differences in innate gifts), given that my grip of the racket is determined by my hand size, not hers, and my toss of the ball is affected by my height, not hers, and given the differences in our muscles? Each difference between me and my instructor could be a problem if I take each instruction for granted. If we learn the basics but do not overlearn them, we can vary them as we change or as the situation changes.

WHOSE BASICS?

Perhaps the very notion of basics needs to be questioned. So-called basic skills are normatively derived. They are usually at least partially applicable for most people some of the time. They are sometimes not useful at all for some people (e.g., how to hold the racket for someone who is missing a finger or how to read a text for someone with dyslexia). They are not useful, however, as first learned, for everyone across all situations. If they are mindlessly overlearned, they are not likely to be varied even when variation would be advantageous. Perhaps one could say that for everyone there are certain basics, but that there is no such thing as *the* basics.

In the classroom, teaching one set of basics for everyone may appear to be easier for the teacher because the teacher needs to know less, a single routine leaves little room for disagreement and hence may foster obedience to authority, and it seems impossible to give individualized training to several people at once.

There are ways, however, to foster mindful learning of basic skills in classrooms full of potential experts. The rationale for this change in approaches is based on the belief that experts at anything become expert in part by varying those same basics. The rest of us, taught not to question, take them for granted.

THE VALUE OF DOUBT

The key to this new way of teaching is based on an appreciation of both the conditional, or context-dependent, nature of the world and the value of uncertainty. Teaching skills and facts

in a conditional way sets the stage for doubt and an awareness of how different situations may call for subtle differences in what we bring to them. This way of teaching imposes no special burden on teachers. Rather, it may increase their own mindfulness as it helps individual students come closer to realizing their potential.

Consider an example that may seem trivial at first, yet speaks to how difficult it is to change what we have mindlessly learned. At a friend's house for dinner I noticed that the table was set with the fork on the right side of the plate. Of course, being polite, I said nothing, although I felt as though some natural order had been violated. I couldn't seem to dismiss the thought that the fork goes on the left side of the plate, even though I was aware that the feeling was preposterous. I even felt that it made more sense in some ways for the fork to reside where my friend had placed it, given that most people in this country would retrieve it with the right hand. Where did my mindset come from? My mother taught me how to set the table when I was young. Her view was not discussed. It was not made into a big deal. It was simply stated, and I mindlessly learned it.

To linger in the kitchen a moment longer, consider how many people cook. Having once been taught when and how to use certain ingredients and spices it occurs to few of us to change recipes to accommodate changes in age, minor health problems, seasons, and the like. Yet unintentional changes sometimes bring about useful learning.

Once a year I attempt to bake. I have a wonderful recipe for marble cheesecake, which I appear to be unable to ruin. The

first time I made it I put it in the oven for a few minutes and then realized I had forgotten to add the heavy cream. I took it out of the oven and added the cream. The next time I used light cream, followed by half-and-half on the next occasion, with perfectly acceptable results. When I add the chocolate, for some reason the cake ends up speckled instead of marbled. Never having learned how to bake, I didn't see these deviations from the recipe as a disaster. I simply changed the name of the cake so it is not an inferior marble cheesecake. This no-fault cheesecake always tastes delicious to me because I use only ingredients I like, but more important, I enjoy varying it rather than mindlessly following an unconditional recipe.

Most of what we learn in school, at home, from television, and from nonfiction books we may mindlessly accept because it is given to us in an unconditional form. That is, the information is presented from a single perspective as though it is true, independent of context. It just *is*. Typically, no uncertainty is conveyed. Much of what we know about the world, about other people, and about ourselves is usually processed in this same way.

We can learn a skill by accepting at face value what we are told about how to practice it or we can come to an understanding over time of what the skill entails. Even in the latter case, we eventually try to get the skill down pat. In research Lois Imber and I conducted many years ago, we found that when people overlearn a task so that they can perform it by rote, the individual steps that make up the skill come together into larger and larger units.² As a consequence, the smaller components of the

activity are essentially lost, yet it is by adjusting and varying these pieces that we can improve our performance.

Recently, with students Dina Dudkin, Diana Brandt, and Todd Bodner, I set out to test more directly the idea that teaching material conditionally allows students to manipulate the information creatively in a different context. Some ways of teaching conditionally may be surprisingly simple.

In a pilot experiment, high school students with the same basic experience and education were taught a lesson in physics.³ The lesson was on videotape, and all the students saw the same videotape. Before viewing the tape, however, half the students received an instruction sheet informing them that their participation consisted of two parts: "Part I consists of a 30-minute video that will introduce a few basic concepts of physics. Part II involves a short questionnaire in which you will apply the concepts shown in the video. The video presents only one of several outlooks on physics, which may or may not be helpful to you. Please feel free to use any additional methods you want to assist you in solving the problems." The other half of the group was told the same thing but with no mention of several outlooks or of additional methods. Our hypothesis was that the instruction to allow for alternatives would encourage mindful learning.

On direct tests of the material, the groups performed equally well. For questions that required students to extrapolate beyond the information given, to use it creatively, a different picture is emerging. Although nothing in either the video or the instructions forbade using previous knowledge and experi-

ence to help solve these problems, only the students given the mindful instructions tended to do so. Students who were not given these instructions were the only ones to complain about the material. Although it is too early in this investigation to be sure of the results (a situation of mindful uncertainty), a prior study done with Alison Piper, described fully in *Mindfulness*, suggests there is merit in this approach.⁴ In that study students were introduced to a set of objects either conditionally ("This could be a . . .") or in absolute form ("This is a . . ."). As in the pilot study just described, we tested to see whether conditional information allowed for alternatives. We found that only those students taught conditionally thought to use the objects in creative ways.

Another way of presenting information mindfully makes use of students' mindlessness. This approach was suggested to me by Jerry Avorn of Harvard Medical School. In a lecture given to our department he told of a drug that was tested in a randomized clinical study. Patients were given either the drug or a placebo, an inert substance, and did not know which they were given. On the chalkboard during his lecture Avorn put a list of side effects, such as nausea, headaches, and fatigue, and wrote rather high percentages next to each. Seeing the list, we all assumed that this was a rather risky treatment, only to find out that the numbers corresponded to the placebo group.

In a similar way information, be it from psychology or history, can be presented with figures for the main variables reversed, and students can be asked to come up with explanations for these "facts." We're all very good at working backward

and coming up with reasons to justify any opinion. In so doing we often box ourselves into a single view. I find that as students generate more and more reasons, they become more likely to believe that the “fact” is true. The more we think this way in or out of the classroom, the more we are likely to believe in one right answer. In the classroom, when I reveal that the fact is actually the opposite of what I presented, the students seem to get the point without further discussion. The more often we learn the basics with the recognition, from the start, that there are several, perhaps quite disparate ways of accounting for information, the more open we are to alternatives.

To make this point clearer, consider a presentation of the classic Milgram study on obedience to authority (to students who aren't familiar with it).⁵ In this study subjects played the part of a teacher. They were instructed to administer shocks to a learner whenever he made an error. Unbeknownst to the subjects, the learner was a confederate of the experimenter; despite his cries with every supposed shock, he felt no pain. The shocks appeared to increase in intensity, and subjects were instructed to continue even though the shocks might actually kill the learner. A certain percentage of the subjects obeyed the experimenter and administered the most intense level of shock. In discussing this study for teaching purposes, I make two columns on the chalkboard: percentage of those who fully obeyed and percentage of those who did not. In the first column I write 35 percent and in the second, 65 percent. Students generate explanations for why most people did not obey and I should add, they do so with great certainty: “People don't like to be

pushed around,” “People are compassionate and don't want to see anyone suffer,” and so on. At this point I turn to the board and notice that I “mislabeled” the columns.

Gender differences may also be a factor in whether new skills are learned in an absolute or conditional manner. Lori Pietrasz and I conducted a study to explore this question.⁶ We hypothesized that one reason males typically outperform females on athletic tasks might be a difference in the way they process instructions. In general young girls are taught to be “good little girls” which translates into “do what you are told.” To be a “real boy,” on the other hand, implicitly means to be independent of authority and “don't listen to all you are told.” This difference should be especially salient in sex-typed activities such as sports. Our hypothesis was that motivation to be a good girl would lead to taking in information about the basics in an absolute or mindless way. Similarly, being a bit rebellious was expected to result in conditional or mindful learning.

To eliminate much previous learning, participants were instructed in how to play a novel game: Smack-it ball. The game is similar to squash except that a small racket that fits like a baseball mitt is worn on both hands. Half of the males and half of the females were instructed in how to use the rackets either in conditional or absolute language (eg. “one way to hold your hand might be . . .” vs “this is how to hold your hand”). After practicing the game, we surreptitiously changed the ball to one that was quite a bit heavier and thus required different body movements. We noted performance at this time. It was expected that the instructions would not differentiate the male

groups because they were assumed to conditionalize the instructions no matter how they were given by us. Females on the other hand were expected to be trapped by their original learning—when taught in an absolute manner—and not to adjust to the changed circumstances (the heavier ball). Thus their performance should be inferior to that of those taught in a conditional way. The findings confirmed our expectations. Moreover, when females were taught conditionally their performance was not different from their male counterparts.

It is interesting to consider other sex-typed tasks from this perspective. While girls outperform boys in early math classes, the reverse typically becomes the case in late high school and college. Much of what we are taught about math initially has to be amended as we approach more advanced topics. Initially there are numbers; later we find out that there are prime numbers, irrational numbers, different number systems, etc. The more rigidly we learn the original information, the harder it may be to open up those closed packages to accommodate the new information. “Good girls” learn the basics in an absolute way from the teacher/authority.

SIDEWAYS LEARNING

The standard two approaches to teaching new skills are top-down or bottom-up. The top-down method relies on discursive lecturing to instruct students. The bottom-up path relies on direct experience, repeated practice of the new activity in a systematic way. Although both approaches have their advocates, I

sought a third alternative. Rather than imposing an order from above or repetitively indoctrinating students through practice, my students and I investigated the effectiveness of activities that break with these two traditions. This approach could be called sideways learning. My no-fault cheesecake is an instance of sideways learning. The basics of cheesecake making were repeatedly varied, serving as a rough guide for making the cake rather than a rigid formula.

Sideways learning aims at maintaining a mindful state. As we saw, the concept of mindfulness revolves around certain psychological states that are really different versions of the same thing: (1) openness to novelty; (2) alertness to distinction; (3) sensitivity to different contexts; (4) implicit, if not explicit, awareness of multiple perspectives; and (5) orientation in the present.⁷ Each leads to the others and back to itself. Learning a subject or skill with an openness to novelty and actively noticing differences, contexts, and perspectives—sideways learning—makes us receptive to changes in an ongoing situation. In such a state of mind, basic skills and information guide our behavior in the present, rather than run it like a computer program.

Mindfulness creates a rich awareness of discriminatory detail. Theories that suggest that we learn best when we break a task down into discrete parts do not really make possible the sort of learning that is accomplished through mindful awareness of distinctions. Getting our experience presliced undermines the opportunity to reach mindful awareness. Sideways learning, however, involves attending to multiple ways of carving up the same domain. It not only makes it possible to create

unlimited categories and distinctions to differentiate one task from another, but it is essential to mobilizing mindfulness.

Can novices be jostled into mindful awareness? How can a situation release our full mental resources and increase our ability to learn and retain complex skills? One pilot study (discussed later) suggests that expertise is not dependent on a particular hierarchical assimilation of basic skills, but that greater effectiveness and mastery may be accessible through inventive transformations of the routine.

Much traditional training, such as developed and organized training in classical piano, leads many people to believe that technique is identical to the internalization of some set of rules for correct performance. Yet the observations of critics evaluating a performer often raise questions about this assumption.

Certain players seem almost exclusively absorbed in the action of their fingers over the piano keys, as if forgetting how the rest of the body participates in playing and contributes to the support of the hands. If a pianist is preoccupied with the voluntary, manipulable end of the spectrum of neurological possibilities, this preoccupation resounds in the music. The performance sounds calculated, not shaped from a spontaneous response. Hence critics often comment on virtuosos who, for all their technical brilliance, are unfeeling, or mechanical, or characterless, and so on. Walter Giesecking, a well-known German pianist, asked his students to learn the music away from the piano, so as to do away altogether with attention to technique and correctness.

In such players there may be a lack of smooth coordination between agile hands and a motionless or inexpressive trunk. The

energy generated for striking the keys is isolated.⁸ In a truly great performance all technical skills are transformed into a unique, context-sensitive, one-of-a-kind experience. This raises the question of whether technique, assimilated through hours of drill, is the essential or even the primary ingredient of mastery.

Expertise, of course, involves several dimensions. First, some element of genetic endowment may differentiate initial aptitude. Animals are born with the ability to walk and quickly manage to accomplish complex tasks requiring balance, acute perception, or navigational ability, a feat that humans could never emulate. Among humans, the existence of prodigies in domains such as music, mathematics, and chess indicates that the initial mental organization of some individuals can predispose them to rapid and relatively untutored mastery.⁹ To explore approaches to learning basic skills, it is necessary to look at skills that are more generally spread across the population, leaving aside the possibility that the truly gifted are different from the rest of us in ways genetically determined.

Clearly, some experience is necessary to acquire complex skills. Yet imagine a coach or piano teacher prescribing a set amount of practice, every day. To claim that any particular amount of time on a task is sufficient to learn that skill overlooks the state in which such practice is approached. How much piano, or golf, or tennis can one learn while daydreaming about some other activity? Pressed to its logical extreme, this teaching method would rely solely on moving the body, with the assumption that the mind would follow. If so, one could learn while asleep simply by having one's body moved in the proper patterns.

Although certain therapies have actually made use of some version of this mode (body therapies or neurolinguistic programming), full mastery is not their goal. Recognizing the difference between going through the motions and moving one's body in awareness brings us into the domain of mindfulness.

J.R. Anderson has described three stages of experience that result in the acquisition of a new skill.¹⁰ The *cognitive* stage involves first taking in enough information about the skill to permit the learner to perform the desired behavior in at least some crude approximation. This stage often involves self-talk, in which the learner rehearses information required to carry out the skill. The *associative* stage involves smoothing out performance. Any errors in the initial understanding of the skill are gradually identified and eliminated in this stage, and at the same time there is a drop in self-talk. The *autonomous* stage is one of ongoing gradual improvement in performance. In this stage improvement can continue indefinitely.

Paul Whitmore, Douglas DeMay, and I investigated whether learning can in fact be improved by changing the mode of the initial learning, the cognitive stage. In a small study, novice piano players were introduced to a simple C-major scale under two conditions, explicitly mindful or traditional practice. People were recruited for the study through flyers announcing a free piano lesson. They were randomly assigned to one of two groups. All subjects were given essentially the same instruction in piano, with the following variations. Members of group 1, the mindful instruction group, were instructed to be creative and to vary their playing as much as

possible. These subjects were told: "We would like you to try to learn these fingering exercises without relying on rote memorization. Try to keep learning new things about your piano playing. Try to change your style every few minutes, and not lock into one particular pattern. While you practice, attend to the context, which may include very subtle variations or any feelings, sensations, or thoughts you are having." Halfway through the session they were reminded to try to keep learning new things, to change the approach every few minutes, and not to lock into any single pattern. Then the specific lesson was given, and subjects spent twenty minutes practicing it. The control group was taught to practice in a more traditional, memorization-through-repetition style.

The piano playing was taped for evaluation. Two graduate students in music who had extensive keyboarding and compositional experience rated the playing. In addition, subjects were asked how well they liked the lessons. The findings of this study confirmed our hypotheses. In comparison with the control group, the subjects given mindful instruction in the early steps of piano playing were rated as more competent and more creative and also expressed more enjoyment of the activity.

Many keyboard masters played the organ while becoming expert on the piano. Mozart, Beethoven, Schumann, and Glenn Gould, for example, recommended organ practice to achieve greater clarity in composing and playing the piano.¹¹ Yehudi Menuhin said he thought his violin playing improved after he took up the viola. To play two similar but different instruments at once works against taking one set of basic skills for granted

and thereby encourages an alert and mindful state. An awareness of alternatives at the early stages of learning a skill gives a conditional quality to the learning, which, again, increases mindfulness.

CAN A TEXT TEACH MINDFULLY?

Because a lot of learning takes place not from exercises planned by an individual teacher but from a textbook, the question arises whether a textbook can inform mindfully.

Todd Bodner, Randy Waterfield, and I tested the hypothesis that with slight modifications textbooks could encourage creative use of learned material.¹² We chose a learning situation that has broad implications for the world of finance. The Series 7 Examination is an exam that every stockbroker, indeed, nearly every person who wants to be involved in investment-related employment, must pass. It is the equivalent of the bar exam in law and carries with it similar stress and concern for a passing grade. It is a comprehensive test intended to protect the investors from people who are not competent to advise them.

We obtained a copy of the Series 7 preparation and testing materials and chose a twelve-page chapter to rewrite. Our selection was guided by two criteria: first, the material had to be obscure enough that our research participants would be unfamiliar with it, and second, understanding the material had to be crucial to passing the test. The chapter was rewritten so that all statements originally expressed in absolute terms now conveyed a more conditional meaning. For example, the original text read,

“Municipal bonds are issued by states, territories, and possessions of the United States, as well as other political subdivisions. Such political subdivisions would include counties, cities, special districts for schools, waterworks, sewers. Public agencies such as authorities and commissions also issue municipal bonds.”) The more conditionally written text reads: “In most cases, municipal bonds are issued by states, territories, and possessions of the United States, as well as other political subdivisions. Such political subdivisions may include counties, cities, special districts for schools, waterworks, sewers, and other public purposes that may require the issuance of municipal bonds. Public agencies such as authorities and commissions may on occasion issue municipal bonds for a wide variety of public projects in addition to those mentioned above.” As another example, the original text read, “For local jurisdictions such as cities, the most common taxing power is on property. An *ad valorem* tax on the assessed value of real estate is the source of funds the local government uses to support its expenses and debt (GO bonds). School taxes are also charged at the local level.” The mindful text read, “For local jurisdictions, which could be counties and cities, the most common taxing power may be on property. An *ad valorem* tax on the assessed value of real estate is probably the source of funds the local government uses most often to support its expenses and debt (GO bonds). Of course, there are other ways a local jurisdiction can obtain money, one of which is through school taxes.”

Harvard undergraduate students served as subjects. They were randomly divided into two groups. Half received the original version of the material, and half received the more

conditional version. Students studied the material for twenty-five minutes and then took a two-part test. The first part tested creative use of the learned material. The second part tested students' grasp of the factual material through a multiple-choice format. In addition, we asked questions to determine whether the students liked the material they studied.

In the test of creative use of the material, students were asked, for example, to "write as many different purposes for municipal bonds that you can think of." The multiple-choice test asked such routine factual questions as "Which of the following supplies money to a local jurisdiction? (a) *ad valorem* taxes; (b) school taxes; (c) parking tickets; (d) a & b; (e) a, b, & c."

Both groups performed similarly on direct tests of the material, but when creative use of the information was required, subjects who had studied from the mindful text clearly outperformed the other group. For our first example, for instance, students who had read the mindful text supplied six answers, whereas those who had read the original gave only four. For the tax question, 100 percent of the group instructed mindfully gave the correct answer (e), whereas only 36 percent of the other group answered correctly. In addition to outperforming the comparison group on the questions requiring some creative use of the information, the mindful learning group tended to like the material more.

To consider another example, imagine reading a programmed text on cardiopulmonary resuscitation (CPR). In very small steps, one by one, it teaches you how to rescue an

adult. You've got it down pat. Another part just as methodically teaches you how to rescue an infant. You know all the required steps. A week after reading the text you are at a friend's pool when her seven-year-old daughter gets in over her head and needs CPR. There's not much time. What do you do? Now imagine that you learned each step of the original lesson conditionally, that is, with a sense that it might have to be adapted rather than as mindlessly sequential. Contrast your quandary in these two cases. You might now be better prepared to adjust to this new situation and more adequately adapt the steps to suit a fifty-pound child. Which way would you want to learn the lesson? How should we teach it?