Introduction:
A Whole New Ball Game

BASEBALL FOR ME WAS A TRIUMPH OF MEDIOCRITY. I WASN'T ESPECIALLY GOOD at it, but I wasn't awful either. This was an achievement because I didn't show much talent for sports in general. I was not bad at batting. A hit got this chunky child chugging around the bases, sometimes picked off but sometimes scoring. Perpetually assigned to the outfield because of my incompetence at catching, I would reliably miss the flies that came my way.

Maybe this mediocrity sounds dismal, but I was pleased with what I could do. I enjoyed playing baseball as one of a dozen ways I could spend a couple of hours on a summer afternoon. Moreover, in the years since those days I've come to an odd conclusion about those early learning experiences: The results were only so-so but the process was pretty good.

So what was the process? I remember my father teaching me to bat in our backyard. He showed me how to place my feet, how to hold the bat, how to swing. Keep your eye on the ball, he said—the familiar incantation! He pitched with a gentle underhand as I tried to get the hang of it all.

One summer I participated in Little League baseball. I didn't like the formality and elaborateness of it. Most people were taking the whole thing as seriously as a military campaign. Still, I did it: practiced catching, practiced batting, ran the bases, stood in the field, missed

the flies. With more fondness, I remember casual games in anybody's backyard, seven or eight kids, just two bases or maybe one, not bothering with nine innings, sometimes not even bothering to keep score, simply playing.

So why would I say the process was pretty good? In a gut sense it was pretty good because I enjoyed playing and learning. In a more analytical sense, it was pretty good because from the beginning I built up a feel for the whole game. I knew what hitting the ball or missing the ball got you. I knew about scoring runs and keeping score. I knew what I had to do to do well, even though I only pulled it off part of the time. I saw how it fit together.

All this sounds very ordinary, but I'm simply stunned when I think how rarely formal learning gives us a chance to learn the whole game from early on. When I and my buddies studied basic arithmetic, we had no real idea what the whole game of mathematics was about. (Maybe you're thinking: Well, how could you? You were just kids and mathematics is an elaborate technical discipline. But I'm not so sure that the basic shape of doing mathematics requires calculus or algebra or even fractions.) Or I think about learning the facts of the Civil War, without getting much of the sense of how anyone found out these facts or what one might do with them—say, compare them with other civil wars in other times and other nations. (Maybe you're thinking: Well, how else could one make a start for youngsters who don't know very much history to begin with. But I'm not so sure that one has to start in such a piecemeal manner.)

Put it this way: When I was playing baseball, most of the time I wasn't playing full-scale, four bases, nine innings. But I was playing a perfectly suitable junior version of the game. A junior version was just right for my size and stamina and the number of kids in the neighborhood. But when I was studying those shards of math and history, I wasn't playing a junior version of anything. It was kind of like batting practice without knowing the whole game. Why would anyone want to do that?

Of course, there was also a lot wrong with the way I learned baseball. For one thing, baseball wasn't a campaign for me, just a pastime, and really serious learning of almost anything has to be something of

a campaign. Even so, those sunny afternoons with the smell of grass and a bit of sweat and a cheap leather glove on my hand still linger in my mind. And today I wonder: Maybe learning most things should be more like learning how to play baseball.

Approaching Complexity

Some learning comes easy. You walk into a new shopping mall and quickly and almost automatically get oriented to the major landmarks: the bookstore, the department store, the electronics store, the food court. We soak up first languages quite spontaneously. The time-on-task is enormous, but the process is so programmed into human nature and so socially supported and so woven into the activities of everyday life that it happens with little deliberate attention.

However, much of what we need to learn poses significant challenges. Baseball is a complicated game, not at all like walking into a shopping mall and almost automatically getting oriented. So is basic arithmetic or algebra, reading, understanding literature, scientific inquiry and the scientific worldview, historical understanding and its relevance to current times. Also challenging are less academic areas, such as management and leadership, sustaining good relationships with other people, and social responsibility.

In all these cases education formal or informal faces its most fundamental and general problem: approaching complexity. Education aims to help people learn what they cannot simply pick up as they go along. Education always has to ask what can be done to make challenging knowledge and practices accessible.

This question becomes particularly acute in formal settings of learning such as schools and universities, with large numbers of people and vast amounts of content. Here are the two most popular answers to approaching complexity:

1. *Elements first.* Ramp into complexity gradually by learning elements now and putting them together later.

2. *Learning about.* Learn about something to start with, rather than learning to do it.

Let's look at them in turn.

Approaching complexity by way of elements has enormous appeal. Starting with elements first works quite well for producing cars on an assembly line out of drivetrains, engines, and tires. It works quite well for fashioning prefabricated houses out of walls and windows and roofs. The logic of assembly is so natural that one finds elements first in almost any niche of learning from kindergarten to corporate training. Students study elements of arithmetic such as addition, subtraction, multiplication, and division, with the promise that eventually they will have a chance to put them together to solve meaningful problems. Students study the elements of grammar with the idea that the knowledge will later coalesce into comprehensive, compelling, and of course correct written and oral communications.

The problem is that elements don't make much sense in the absence of the whole game, and the whole game only shows up much later if at all. For instance, very little that schools ask youngsters to do around arithmetic is a good example of how arithmetic gets used in everyday life, and there is hardly anything early on worth calling mathematical thinking. Or take writing: I remember discovering with alarm that my youngest son had learned all the elements of writing, but his teachers rarely asked him or any of the other students in his classes to do much extended writing. So troubling is this trend of approaching things through elements with the whole game nowhere in sight or a minimal presence that I like to name it as a disease: *elementitis.*

I remember sharing some of these ideas with a group once, and a lady put up her hand with an interesting puzzle: "I have two daughters who are very different from one another. One likes just to dive in, but the other one likes to take things a piece at a time and feel well prepared before attempting 'the whole game.' Isn't that okay?"

Sure it is. *Elementitis* does not mean learning a few elements and putting them together into the whole game right away. Elements first can be a good short-term strategy. *Elementitis* means week after week,

even year after year of focusing on elements with very little of the whole game ever played.

It would be comforting to think of *elementitis* as a rare disease. Not so. Common experience testifies to its common character. So does hard evidence. In *The Right to Learn,* Stanford educator Linda Darling-Hammond logs how narrow curriculum standards, bloated textbooks, and the pressure for coverage have led to a piecemeal curriculum. Every conceivable topic gets its fifteen minutes of fame. In a 2007 *Educational Researcher* synthesis of multiple sources, Wayne Au reports how the influence of the U.S. No Child Left Behind policy has both narrowed and fractured the curriculum. What's not relevant to the test gets dumped and what is relevant gets chopped up into test-sized bites. This doesn't have to happen. Some schools manage the challenges of No Child Left Behind better, and some states test in more meaningful ways. It doesn't have to happen . . . but it's the trend.

Harvard psychologist Ellen Langer would characterize such education as *mindless.* For decades, Langer has sustained a rich line of research on mindfulness and mindlessness, demonstrating that in many ordinary circumstances people fall into blind and narrow patterns of thought and behavior, muddling up situations where they could proceed more thoughtfully. However, people can cultivate a more mindful flexible stance, open to new information and aware of multiple perspectives. In *The Power of Mindful Learning,* Langer warns of the general trend in education toward mindless patterns of learning and shows how it need not be that way. One particular hazard akin to *elementitis* is the idea that the basics must be mastered so well that they become second nature. Another is a culture of deferred gratification, with the rewards of actually "playing the game" always coming later.

Now let's consider the other almost universal strategy for approaching complexity, learning *about* something toward learning to do it. Reading and mathematics generally escape this, since students certainly learn to do, but learning *about* dominates early learning in disciplines such as history and science. Typical history instruction has been characterized as learning "other people's facts." It's acquiring information about a particular version of history, with very little thoughtful

interpretation or critical perspective. One might equally well describe the typical study of science as learning "someone else's theories." Students become familiar with Newton's laws or the steps involved in mitosis to the point where they can perform well on the quiz or the problems at the end of the chapter. However, a huge body of research on science understanding demonstrates that learners show very limited understanding, bedeviled by a range of misconceptions about what the ideas really mean.

A certain amount of learning *about*, just like a certain amount of elements first, is fine. The problem is overdoing it. The problem is endless learning about something without ever getting better at doing it. So, to parallel *elementitis*, I like to call endless learning about *aboutitis*. Yes, it lets learners acquire some information about the French Revolution and the American Revolution, mitosis and meiosis, the positions of the planets, continental drift, and the tensions of race and status in *Othello*. But this only provides a kind of an informational backdrop rather than an empowering and enlightening body of understanding.

Nor is the problem of *aboutitis* limited to the earlier years of education. Professional education suffers enormously from *aboutitis*, including teacher education, where teachers sit through innumerable sessions concerning learning theory and classroom dynamics with a shockingly small percentage of their time spent playing the game of teaching in various practice roles in schools.

In case *elementitis* and *aboutitis* seem too harsh a characterization of the norms of formal learning, let me acknowledge that even *elementitis* and *aboutitis* can do good up to a point. In less-developed countries starting from hardly anything, traditional straightforward teaching can have quite an impact. Teachers with some measure of teacher education, textbooks in the classrooms, acquisition of basic literacy and numeracy, and general knowledge of the subject matters—all these can be important. The complaint about *elementitis* and *aboutitis* is not that they don't accomplish anything but that we could accomplish so much more.

The natural question is how? The problem of approaching complexity is very real. What option is there besides either taking something

complicated element by element and putting it together much later or only learning about it for quite a while? What else can one do?

An attractive answer is already at hand. It's the notion of the junior version. Remember those simpler versions of baseball that my buddies and I played in backyards on summer afternoons: not element by element, not information about, but engaging junior versions. This is a fundamentally different way of conceptualizing how to approach complexity, and a fundamentally more powerful one. It lets learners in on the big picture, so that the challenges along the way become meaningful. And it gives learners a chance to develop the largely tacit knowledge involved in active engagement, the kind of knowledge we point to when we speak of having a sense of the game or getting the hang of the game.

It suggests a different way of thinking about teaching and learning. More on junior versions later, but let's jump in. Let's look at the entire concept in summary form.

Seven Principles of Learning

So, what if learning most things could be more like learning how to play baseball, or other activities we usually learn as wholes? Learning most other sports works the same way. Most games such as bridge or checkers or chess or backgammon are learned as wholes. And so are the arts: From the start, one spends much of the time crafting whole drawings or paintings or poems. Likewise with musical performance: From the very beginning, one sings entire songs and plays entire pieces. So let me try to outline a general way of thinking about good learning that follows the spirit of learning how to play baseball or play an instrument or paint a landscape.

By "general" I mean something that can work in just about any place and for just about anyone at all. I'm not only speaking of classrooms or church groups or on-the-job learning. And it can be applied to pretty much anything you might imagine—the theory of relativity, skating, calculus, making and keeping friends, business management,

the poetry of T. S. Eliot, speaking Mandarin, making beds or making quilts. It really doesn't matter, because the big principles are the same.

In the spirit of learning the whole game, we can call this broad view *learning by wholes* and divide it into seven principles. I will list these principles here, go over each of them briefly in this chapter, and then explore them more fully in the later chapters.

The Seven Principles of Learning by Wholes

1. Play the whole game.
2. Make the game worth playing.
3. Work on the hard parts.
4. Play out of town.
5. Uncover the hidden game.
6. Learn from the team . . . and the other teams.
7. Learn the game of learning.

1. Play the Whole Game

Another thing my father taught me besides how to hold a bat was how to play checkers. We began with the whole game, and I won the first game I ever played. He explained the rules briefly, reminded me of them as we went along, let me take my time, and amazingly, I captured all his pieces!

A little too amazingly even for the young and naïve kid I was. "Did you let me win?" "Yes," my father confessed, honest to a fault as always.

"Don't do that!" I complained. "Okay," my father responded. He was a man with considerable quiet pride, and he could understand my pride too. From then on for two or three years, before the habit fell away as these things do, the two of us would play from time to time, but I never ever beat him again! Still, I got considerably better and I had fun anyway. I enjoyed the process of learning the whole game, whether I won or not.

We can ask ourselves when we begin to learn anything, do we engage some accessible version of the whole game early and often? When we do, we get what might be called a "threshold experience," a learning experience that gets us past initial disorientation and into the game. From there it's easier to move forward in a meaningful motivated way.

Much of formal education is short on threshold experiences. It feels like learning the pieces of a picture puzzle that never gets put together, or learning about the puzzle without being able to touch the pieces. In contrast, getting some version of a whole game close to the beginning makes sense because it gives the enterprise more meaning. You may not do it very well, but at least you know what you're doing and why you're doing it.

2. Make the Game Worth Playing

Schools and other settings of learning ask us to do many things that aren't all that enthralling. We feel as though we are playing the school game and not the *real* game. We learn the ritual of inverting and multiplying to divide fractions, a numerical somersault with mysterious motives that hardly anyone understands . . . it's just what you do. Or we memorize the dates of the presidents or the wives of Henry VIII, or we practice crafting paragraphs with good topic sentences.

Now and again some pushy student asks the deflating question, "Why are we studying this?" The answer forthcoming from the teacher or maybe anticipated by the text pretty much has to be something like this: "You'll need to know it later." "You need it for the test." "It's on the objectives for this unit."

So what makes a game seem worth playing? In fact, we've already seen one of the simplest contributing factors: Play the *whole* game. Inverting and multiplying, memorizing names and dates, practicing paragraph structure, these are bits and pieces that make sense in the context of the whole game. But they don't make sense unless the whole game of mathematical thinking or historical understanding or discursive and expressive writing gets played often enough in a junior

way to make it familiar. Playing the whole game clarifies what makes the game worth playing, because you see right away how things fit together.

To be sure, some whole games are not all that interesting to most learners and no one is going to be interested in everything. Even so, whole games help, and artful teachers use many other ways to connect learners with what's interesting about a topic. The full importance of a topic is not always going to be apparent at once. Even so, there are many honest ways to preview the importance of something instead of just saying, "You'll need to know it later."

3. Work on the Hard Parts

My parents played bridge regularly with another couple for many years. Eventually I learned to play bridge also and tag-teamed into the game sometimes, or my wife and I played with my parents. Only then did I become aware that my parents weren't getting any better. They were doing and doing, but not learning by doing.

Think about something that you've done for a number of years. Very often, you will find that you're not getting any better at it. The missing ingredient is usually our third principle: Work on the hard parts. At the very beginning of learning something this isn't as important as getting oriented to the whole enterprise. However, as the learner settles into the pattern of activity, the hard parts start to emerge.

The hard parts have an annoying characteristic: They do not always get better just through playing the whole game. Real improvement depends on deconstructing the game, singling out the hard parts for special attention, practicing them on the side, developing strategies to deal with them better, and reintegrating them soon into the whole game. Batting practice!

Normal schooling includes significant work on the hard parts. That's good. But there's usually not enough of this kind of work, and it's not individually targeted. As I think back on my schooling, all the way from kindergarten through university, it's amazing how rarely I had the chance to revise anything to strengthen the hard parts.

Shortly after handing something in, I would get a few corrections back with comments like "95 percent," "70 percent," "nice point," "needs further evidence"—not enough information to diagnose effectively exactly what was hard about the hard parts and no chance to tune them up because we were already continuing on to the next topic.

4. Play Out of Town

Back to baseball: There's the home-field advantage phenomenon. When the Boston Red Sox get to play in Boston's Fenway Park, not only do they benefit from the support of an enthusiastic crowd, but also from familiarity with some very definite quirks of the stadium. You can talk about the home-field advantage for any sport, but it's particularly significant in baseball, where various stadiums around the country have their own idiosyncratic layouts.

The dark side of home-field advantage is the away disadvantage. When the Boston Red Sox play out of town, it's a problem, but it's also a learning opportunity. The new setting challenges the players to stretch and adapt their skills and insights. They can find out how best to capitalize on a different circumstance, and maybe generalize what they learn so that the next away-from-home stadium after that becomes a little less of an away disadvantage.

Does a different setting matter that much? Looking across sports, this varies a lot. For sports played indoors on highly standardized courts it matters least. In contrast, football commonly brings traveling teams to weather they are not used to, say, playing in a blizzard. In tennis, differences between grass, clay, and hard courts influence considerably who has the best chance in a tournament. The extreme team sport of adventure racing deliberately places small teams in wilderness areas unfamiliar to them. They need to figure out their own routes between designated stations to cover long distances over dangerous terrain as quickly as possible. A systematic study of adventure racing conducted by my colleague Daniel Wilson reveals the remarkably complex and tricky interactions among team members as they cope and learn in the midst of races. Adventure racers are *always* playing out of town!

Beyond sports, the same out-of-town phenomenon applies in various degrees to learning anything. The whole point of formal education is to prepare for other times and other places, not just to get better in the classroom. What we learn today is not for today but for the day after tomorrow. Sometimes the day after tomorrow is pretty much the same as today, but it very often isn't.

The trouble is, in formal education usually no one sends us out of town to play and broaden our experience. The ideas and algorithms in mathematics are very general, but in practice students focus on a few stereotyped exercises about trains or sailboats or buying apples. The ideas about good citizenship are very general, but in practice students focus on a couple of stories about voting or community service. Even the classroom across the hall may be too far away. One of my favorite quips about learning, remembered for many years, came from a high school science teacher bemoaning his students' troubles applying mathematics to science along these lines: "It's as though walking across the hall from the math room to the science room, the students forget their math."

Researchers call this the problem of *transfer of learning*. Playing out of town well is not something that happens automatically. Like other facets of learning, it's something we have to work on.

5. Uncover the Hidden Game

Look up "baseball hidden game" on the Internet and one of the first hits you will see is *The Hidden Game of Baseball*, a 1984 book by John Thorn and Pete Palmer. In most people's minds, baseball and math probably do not sit in the same category, but *The Hidden Game of Baseball* brings them together. It's a statistical perspective on baseball, why baseball games and whole seasons play out the way they do, and what smart strategy looks like.

What is true for baseball is true for just about any endeavor—literary criticism, making and sustaining friends, mathematical modeling, playing the stock market, making peace, making war, making art—there is always the hidden game. In fact "the" hidden game understates the matter. Any complicated and challenging activity always has

multiple layers beneath the obvious. Baseball and physics both have their statistical sides, their strategic sides, and even their political sides. There is also a very interesting physics of baseball, although I'm not sure that there is a baseball of physics.

The hidden games are not only interesting but often important to doing well at the surface game. Coaches and managers have to pay attention to the statistical trends in batting and pitching and play the odds. In playing chess, it's essential to attend to broad strategic considerations such as control of the center. In learning science concepts, it's important to have some feel for the underlying principles of causality involved in various scientific theories. Often they are very different from everyday conceptions of causality. Without a sense of the hidden game, you are likely to misunderstand what's going on.

A great deal of learning proceeds as if there were no hidden games. But there always are. They need attention or the learners will always just be skating on the surface.

6. Learn from the Team . . . and the Other Teams

Do your own work! If there were Ten Commandments for the conduct of pupils, this is a pretty good candidate for the top of the list; good by the measure of common practice but odd by the measure of how society works. Hardly anything we do is done solo. No matter whether you are an athlete, a business person, a scientist, a trash collector, or a clerk, you are almost always coordinating with other people in a complex way. Human endeavor is deeply and intrinsically collective, except in schools.

That is why on this list of seven principles for learning we find "learn from the team . . . and the other teams." It's actually very hard to learn well from a single source, from a passive text or from a teacher who has many others to attend to besides yourself. Much better is a personal coach, but most individuals cannot afford that, nor can most societies afford to provide personal coaches for any process of wide-scale learning! And even that personal coach can only tell you about the art and craft of coordinating with others on whatever team you're on, not do it for you.

To be sure, some activities are more naturally solo than others. It's easy to make reading into a group activity but harder for writing, although it can be done. However, the principle of learning from the team and the other teams should be interpreted generously. The principle concerns not just activities that naturally have a group character, but also about learning from others engaged in the same pursuit—friends, partners, colleagues, rivals, enemies, paragons, mentors, even learners not as far along as oneself.

7. Learn the Game of Learning

Many people study a second language and some people get to a third language. Learning that third language is an interestingly different experience from working on the second. Learning any language beyond your mother tongue is very challenging, but hour per hour the third is usually not as daunting as the second. In learning your second language, you develop a better understanding of how grammars are organized, so it's easier to make sense of the grammar of the third language. The rhythms of memorizing vocabulary and syntactic structures have become familiar. You have learned something in addition to the second language itself, something about how to learn languages.

Learning to learn is a much more general phenomenon than learning to learn languages. Even nonhuman mammals learn to learn in a kind of a rudimentary way, getting used to and often engaged by the rhythms of the training process. Learning to learn has to do with many things: directing one's attention, choosing time and place, relating new ideas and skills to what you already know. Indeed, it has a lot to do with the previous six principles. The self-managed learner makes a point of practicing the hard parts, even when no coach or teacher imposes a regimen. The self-managed learner makes a point of playing out of town—connecting ideas and skills with other contexts—even when no coach or instructor sends the team out of town.

I can hardly think of anything more worth learning than learning to learn. It's like money in the bank at compound interest. Unfortunately, most settings of learning give very little direct attention to learning the game of learning.

A Matter of Order

Does the order of the seven principles have any special significance? The earlier principles are not more important than the later ones. Nor do we need to pay attention to the principles in their numerical order. For instance, sometimes a topic lends itself to uncovering some feature of the hidden game (#5) or learning from the team (#6) early on.

Play the whole game comes first because that is the central idea. *Learn the game of learning* comes last not because it's the last thing to address but because learning to learn is a superordinate agenda cutting across particular topics. In between, the order simply seemed to make a good narrative. If you'd like to think of the principles in a different sequence, by all means do so.

Yes, But . . .

I hope that all this makes sense. I hope it aligns with many good and bad and middling learning experiences in school and out of school that people remember. I hope that others besides me recall what it was like to learn to play baseball or some other sport or game they enjoyed, getting the hang of it without necessarily being very good at it early on. I hope that others besides me recall what it was like to develop a particular art or craft, getting the hang of it without necessarily being very good at it early on. I hope others besides me recall the empty *elementitis* of learning the pieces without the whole game and the not very interesting *aboutitis* of learning about something endlessly without ever getting to do it.

Even so, learning by wholes could seem like an idealistic undertaking, as far away from practical attainability as the top of the Matterhorn, so let's briefly counter some reservations.

One natural "Yes, but . . ." stems from the fact that mathematics, history, and science are structured much more loosely than baseball, bridge, and badminton. These three B's are designed as games with rules, but what is it to play the "whole game" of mathematics, history,

or science? What is it to play particular games within them, say seeking a mathematical proof, assembling and assessing historical evidence, or designing and running an experiment? *Part of my mission in the rest of the book is to convince you that the whole game metaphor points in useful directions.* Even though the academic disciplines have few strict rules, there are rules of thumb, guidelines, conventional practices, typical forms, widely used strategies, and the like that help to define the "game."

For another natural objection, some disciplines—mathematics again is a good example—seem like pyramids. You can't build the top of the pyramid before you put the bottom in place. You can't ascend to heights of understanding and creative problem solving until you establish some foundational facts and routines. There is no junior version of the game, this objection says. *Part of my mission in the rest of this book is to make the case that there is always a junior version.* While the pyramid has a certain reality, there are legitimate and energizing junior versions in the several disciplines for the beginning learner.

Let me add that we shouldn't just be interested in learning within the disciplines. There are many other types of learning that matter as much—for instance, skills and attitudes of leadership, human relations, moral decision making, and citizenship. As with academic disciplines, although there are not strict rules in such areas, there are certainly guidelines, conventions, strategies, and so on that help to frame what it is to "play the game."

However, there are many good sources about theories of learning and how they connect to education, for instance, Bransford, Brown, and Cocking's *How People Learn.* So one might wonder, "Do we really need another theory of learning? We already have such scholarly perspectives on learning as behaviorism, constructivism, and human development."

Good question . . . and some good news: Learning by wholes is not a theory of learning to rival others at all. Learning by wholes is a theory of teaching, or more broadly, educating. Learning is a much broader category than education. Learning happens incidentally all the time—in casual conversations, in the supermarket, on the street, playing shoot-'em-up video games, puzzling over stock market investments.

Education is choreography for learning, an effort to organize learning for greater timeliness, focus, effectiveness, and efficiency. That is where learning by wholes comes in.

Learning by wholes incorporates various learning theories to offer a design framework. Learning by wholes is an integrative approach for keeping in mind and keeping in action many key features of learning toward educating well. It's what is sometimes called a theory of action. *Part of my mission for the rest of the book is to show the learning science underneath each one of the seven principles of learning by wholes.*

Let's start now. Without reviewing much about behaviorism, constructivism, or any other view of learning, let me sketch very broadly how learning by wholes relates to them. Learning by wholes is not very behaviorist in tone, especially if we are talking about hard-core behaviorism, which denies the existence of minds and intentions. Learning by wholes treats learners as aware and active and capable of becoming more so.

However, learning by wholes does share with behaviorism the idea that things go better when feedback is immediate and informative and when the incentive structures around an endeavor are largely positive and not deeply threatening.

Learning by wholes is very constructivist, embracing the idea that learners always in some sense construct their own meanings from learning experiences. Indeed, learning by wholes is one way of putting meat on the rather sketchy bones of generic constructivism. Discovery and inquiry learning can be understood as particular spins on constructivism, and some examples in the pages to follow have the flavor of discovery or inquiry learning.

However, learning by wholes definitely does not say that all learning should be aggressively discovery oriented. What suits a particular topic is something of a judgment call. There are many occasions, including in most sports and games, when the best way to get started on something is to explain and demonstrate it clearly, ask learners to try it and try it again, and coach them through a process of improvement. This is a far cry from inviting them to figure it out for themselves with an occasional hint.

In very general terms, a developmental perspective on learning foregrounds how people's readiness for learning changes. In the course of years, children and adults develop broad cognitive capacities, views of knowledge, and ways of understanding that enable more powerful thinking and learning. A learner more advanced along a developmental trajectory can be much more "developmentally ready" to learn a particular idea or topic with understanding. Also, learners of the same physical age may not have the same developmental age. Well-designed learning accommodates different levels of readiness within the same group.

So how does learning by wholes fit in? Learning by wholes certainly urges sensitivity to developmental readiness as a general matter. Learning by wholes does not foreground one specific developmental model over others, because the field of human development is so complex, a whole story in itself. Some further ideas about development appear in the next chapter and toward the end of Chapter 5.

Finally, a word about technology. When well used, contemporary information technology provides powerful approaches to learning. Technology can bring to students whole games to which they would otherwise not have access. For instance, computer simulations, online research tools, and e-mail communication can help learners pursue collaborative investigations or thoughtful critical discussions about tricky issues. Again, some examples appear in the following pages.

However, in no way does learning by wholes require such technologies. Many social simulations do not need computers at all, simply face-to-face role-playing. Formal face-to-face debates with their whole-game character predate the Internet and discussion forums by thousands of years.

In summary, rather than offering a new theory of learning, learning by wholes sits comfortably within a number of contemporary ideas about learning and teaching as an integrative theory of action. There are of course other theories of action for organizing learning. You will have to make up your mind which you like or cherry pick what parts of each you find most helpful.

To help you think about it, bear this in mind. The trend in design frameworks for learning is to address any topic without complaining much about how atomistic the topic itself is—dividing by fractions, the dates of the presidents, Newton's third law of motion. In contrast, learning by wholes emphasizes not only how learning might proceed but what the right unit of learning is—the whole meaningful game. Learning by wholes takes a strong stance against learning by elements and against extended learning *about* things when the ultimate idea is to learn to *do* them. *Part of my mission in the rest of this book is to make the case again and again that this holistic emphasis, always with appropriate attention to "the hard parts," is what works best.*

All that said, there is a very different "Yes, but . . ." that deserves a moment of attention. Sometimes people feel uneasy with the game metaphor itself.

One concern is that "game" is too light for serious matters like the plays of Shakespeare or the founding of our nation or the biological origins of human beings. Another concern is the competitive connotations. Most sports and games involve individuals or teams vying against one another, and the competitive characteristics of grades and exams may do more mischief than good.

I *half* agree with both these concerns. I wish that the metaphor of learning the whole game was not so light sounding, although I also sometimes think that we approach the entire enterprise of education too gravely and should lighten up a bit. I also wish that the competitive connotations were softer, although I think that in carefully chosen circumstances certain kinds of mild competition can help to foster learning.

No metaphor is perfect. Whatever our nation is, when we speak of "the father of our nation" (or mother) in some ways this is apt and in some ways it is not. When we say with seventeenth-century British poet and preacher John Donne, "No man is an island, entire of itself; every man is a piece of the continent, a part of the main," we acknowledge a vivid and important truth while pushing into the background some complexities of human autonomy. Metaphors are like oriental rugs: They reveal a compelling pattern, while the complicating lint gets swept underneath them.

In the balance, let me suggest that the concerns with the metaphor itself do not weigh very heavily against the integrative power, and we can learn to watch out for the downside. If you prefer, you can take the seven principles literally and never mind the game metaphor. They might sound something like this:

1. Engage some version of the holistic activity, not just bits and pieces.
2. Make the activity worth pursuing.
3. Work on the hard parts (at least this one sounds the same).
4. Explore different versions of and settings for the activity.

And so on. Doesn't have the zip, does it? But the points are essentially the same and fundamentally important.

So I'm hoping that you will read on to discover the rest of the story. And as you read, if you are in an educative role—teacher, mentor, coach, parent, or even a student managing your own learning—I hope you will try a few things. You might want to construct your own junior version of learning by wholes rather than attempting everything at once! Just focus on the basic principles without worrying too much about the details. Just take two or three of the principles and tease them into motion in simple ways.

In fact, you can probably do a lot with a principle without even looking that far into its details. I've discovered that as soon as I name the seven, they stimulate elaboration from people's own experience without a lot of prompting on my part. Also, at the end of each chapter you will find "Wonders of Learning," a boxed summary of the key ideas. It's written in the first person, as though you were thinking things over, with a series of "I wonder . . ." questions leading into brief answers drawn from the chapter. You are invited to take these questions and others like them to heart and ask and answer them in real contexts of teaching and learning.

After some road testing, if you then turn back to the book, you are likely to find many particulars all the more meaningful. To put everything together, the Afterword offers some reflections on the

experience of learning and teaching by wholes, what principles to foreground early and why, how the craft of learning and teaching by wholes builds over time, and the challenges of educating for a complex globalized and changing world. Remember, we are learners too, and the power of a well-chosen junior version applies to our own learning to teach just as much as to others' learning what we would like to teach them.

On Fruitful Mediocrity

Meanwhile, there is one more doubt worth taking up right here. If learning by wholes is so powerful, why wasn't I better at baseball? In fact, since people usually learn sports and games and arts and crafts in whole-game kinds of ways, how come most people are not better at them?

Of course, there is the talent factor. Remember, I was not particularly good at sports in general. However, this is not the heart of the matter. Besides playing the whole game, there are six more principles of learning by wholes. These were not always operating in my favor. Here is a scorecard with a little explanation.

Dave's Scorecard

- ☑ Play the whole game.
- ☑ Make the game worth playing.
- ☒ Work on the hard parts.
- ☒ Play out of town.
- ☒ Uncover the hidden game.
- ☒ Learn from the team . . . and the other teams.
- ☒ Learn the game of learning.

I played the whole game of baseball and found the whole game worth playing. I didn't just play junior versions either. The one

summer in Little League and many games during recess and physical education in school were nearly full scale versions. However, except for my Little League summer and some early tips from my father, no one got me to work on the hard parts much, and I didn't take playing baseball seriously enough to work on the hard parts by myself. As to playing out of town, there was no out of town for us, just the usual gang of kids at school and in the neighborhood. No one ever told me anything about the hidden game until I was much older. Learning from the team? Only very incidentally. We certainly were not studying one another or trying to mentor one another. Learning the game of learning simply didn't come up.

If more of the magic seven principles had been in place, I would have learned to play baseball with more magic than I did. The moral: Good learning by wholes reaches well beyond playing the whole game a lot. Just as *elementitis* and *aboutitis* offer an overly reductive approach, so only playing a surface version of the whole game makes for an overly holistic approach. People remain mediocre at many sports and games, arts and crafts, and professional endeavors because they spend too much time playing the whole game without putting the other six principles to work.

But perhaps we should recognize a certain value even in this sort of mediocrity. At least it achieves a general sense of and participation in the whole game. Sure, I would like to have been great at baseball, but at least I had learned to *do* something meaningful and had become somewhat better at doing it. I was reasonably happy with my limited skills and well equipped to play now and then, understand baseball talk, follow games on TV, and, decades later, play backyard baseball with my own children. That's worth a lot!

Much of the rhetoric around education emphasizes excellence, and indeed excellence is a fine grail to seek. However, imagine a world where almost any adult had a kind of energetic if simple sense of civic engagement or ecological responsibility or avoidance of prejudice. Starting from the baseline of today's indifference and neglect, these "games" do not have to be played in very sophisticated ways to do substantial good! The world would be a better place if in areas

like these most people achieved active mediocrity rather than passive erudition.

Let's take a longer look at playing the whole game in the next chapter, going on from there to each of the other six principles in turn, for the sake of understanding better how learning works and to make learning work better.

NOTES

Introduction: A Whole New Ball Game

Approaching Complexity (pp. 3–7)

Narrow curriculum standards . . . : Darling-Hammond, L. (1997). *The right to learn: a blueprint for creating schools that work*. San Francisco: Jossey-Bass.

Narrowing effects of NCLB: Au, W. (2007). Hi-stakes testing and curricular control: A qualitative meta-synthesis. *Educational Researcher, 36*(5), 258–267.

Mindlessness, mindfulness, and mindful learning: Langer, E. J. (1989). *Mindfulness*. Menlo Park, CA: Addison-Wesley Langer, E. J. (1997). *The power of mindful learning*. Reading, MA: Addison-Wesley.

"Other people's facts": Holt, T. (1990). *Thinking historically: Narrative, imagination, and understanding*. New York: College Entrance Examination Board.

Learners' science misunderstandings—the literature is vast. Here are some summary sources foregrounding the physical sciences: Driver, R., Guesne, E., & Tiberghien, A. (Eds.). (1985). *Children's ideas in science*. Philadelphia: Open University Press. Gentner, D., & Stevens, A. L. (Eds.). (1983). *Mental models*. Mahwah, NJ: Lawrence Erlbaum. Grotzer, T. A. (2003). Learning to understand the forms of causality implicit in scientific explanations. *Studies in Science Education, 39*, 1–74. Novak, J. D. (Ed.). (1987). The proceedings of the 2nd misconceptions in science and mathematics conference. Ithaca, NY: Cornell University.

Perkins, David. 2009. *Making Learning Whole – How Seven Principles of Teaching Can Transform Education.* 1st ed. San Francico: Jossey-Bass. 1 – 23.