ENGAGING MINDS
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PART C

TEACHING

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Dedication

To Tom Kieren. Teacher.
Acknowledgments

We would like to recognize those teachers, researchers and scholars who have labored to interrupt the assumptions and norms that frame popular understandings of knowing, learning, and teaching. Only a handful of these persons could be mentioned in the pages that follow, but we acknowledge our work is enabled by an extended network of educators and critics who share the hope that formal education can be more than it is.

More locally, we are indebted to undergraduate and graduate students, colleagues, reviewers, and family members whose careful readings and focused responses to the first edition of Engaging Minds have contributed in many and substantial ways to this one. As well, we note the critical assistance of several people who responded to drafts of this version, including Moshe Renert, Juan Carlos Castro, Wendy Nielsen, Gillian Gerhard, Rachel Moll, Valerie Triggs, and Tammy Iftody (at the University of British Columbia) and Ted Christou, Jennifer Davis, Laura McEwen, and Chris DeLuca (at Queen’s University).

Most of the new images for this edition were drawn by Jenny Arntzen. The photographs in chapter 12 were taken by Oksana Bartosh. The cover image was created by Loretta Walz, and Dónal O’Donoghue helped us with the graphic design.

We acknowledge the contributions of our editor, Naomi Silverman, whose gentle provocations and skillful interventions helped to bring this work to form.
Etymology
The word *know* is derived from the Greek *gnosis*, “spiritual knowledge or deep insight,” the complement of which is *episteme*, “everyday know-how.” English is unusual in the fact that just one term encompasses these different facets of knowing. Most other languages have two or more verbs to address the range of meanings. For example, the French terms *connaitre* and *savoir* and the German words *kennen* and *wissen* are used to distinguish between “being familiar with” (persons or things) and “having mastery of” (facts).

**Synonyms**
accept, be acquainted with, be able to perform, apprehend, believe, be cognizant of, comprehend, discern, discriminate, distinguish, experience, be familiar with, feel, fathom, go through, grasp, have, master, meet with, be onto, perceive, prove, recognize, remember, savor, see, be sure of, taste, undergo, understand

**Antonyms**
doubt, forget, ignore, misinterpret, misunderstand

**Cognates**
agnostic, cognition, cognizance, diagnosis, Gnostic, ignoble, ignorant, incognito, notice, notion, notorious, precognition, prognosis, prognostication, recognize
Why is the image of a tree so common in discussions of knowing? We speak of the tree of knowledge and its branches of study. We talk about the seeds of awareness, the roots of understanding, the growth of insight, and the fruit of the labor of learning.

The popular embrace of this organic metaphor is in some ways out of sync with prevailing perceptions of knowledge—which is overwhelmingly discussed as though it were something out in the real world, waiting to be uncovered and taken in by the receptive mind.

But the tree image presses attentions toward a very different web of associations. A tree is a growing and evolving form. It is a whole in and of itself, but it is also a community of parts, including roots, trunk, branches, bark, leaves, and seeds. And each of these parts is itself a community of cells and other vibrant forms.

Of course, the tree can't be reduced to these elements. Its viability arises in the network of connections among subsystems. Their web of co-activity enables the movement of water and food, the gathering and conversion of energy, respiration, and other life functions. A tree, then, is not so much a thing as a rhythm of exchange.*

As well, the very form of a tree is a record of its flow through time. Its precise pattern of branches on branches on branches is simultaneously unpredictable and familiar. The form is similar to the branching patterns encountered in other trees, in their root systems, in the veins of their leaves, in river deltas, in lightning bolts, and in circulatory systems. Yet it is utterly unique, a still-forming product of the interlocked dynamics of climate, seasons, other living forms, and information once contained in a tiny seed.

Perhaps, then, the prominence and persistence of the tree image in discussions of knowledge has to do with the way it reminds the observer of the patterns that connect forms to one another. The image of the tree of knowledge hints at the vibrancy, the sufficiency, the contingency, the evolving character of knowing.

* This phrase is from Neil Evernden, The natural alien: Humankind and environment (Toronto: University of Toronto Press, 1993).
1.1 Interconnectivity

This is a book about teaching.

Unlike most texts on the topic, it isn’t written from the assumption that definitions of teaching are settled—or even that there can or should be broad agreement on meanings. Instead, it’s organized around difficult questions about perception, cognition, action, identity, context, intention, and other issues that contribute to understandings of teaching.

“What is teaching?” is itself a difficult question. In fact, there seems to be only one point of agreement among varied teaching theories, philosophies, and practices—namely that teaching has something to do with prompting learning.

And that point, of course, begs the question, “What is learning?” As tempting as it might be to think that this one has been answered, in fact learning is an extremely complex phenomenon that is not yet well understood. Like the phenomenon of teaching, learning is interpreted in a stunning variety of ways. And, also like teaching, there seems to be little agreement among those interpretations—save for the suggestion that learning is about transforming what is known.

So, then, what is knowing? This is the question that we start with in this book. In Part A we ask: What is knowledge? What does knowledge do? What does it mean to know? What is a knower? It turns out that these are not trivial questions, and emergent answers are presenting some immense challenges to commonsense beliefs.

Part B is focused on learning: What is learning? How does it happen? What is a learner? Why are some learners so much more capable than others? Can intelligence be enhanced? As with the topic of knowing, emergent insights into these issues can be challenging, particularly within discussions of teaching.

Part C deals with that topic. As might be expected, it too offers contrasts to entrenched beliefs and practices. Informed by the discussions of knowing and learning, and seeking to be attentive to the contingencies of time and place, the intention in this section is to present a practicable conception of teaching that is fitted to the world in which we find ourselves.
In many ways, the discussions presented here are as much attempts to recover lost or repressed insights about knowing, learning, and teaching as they are attempts to unsettle popular beliefs about formal education. The core themes of complexity, interdependence, emergence, and transformation reach deeply into the history of human understanding. They are evident in the myths and folklore of virtually every culture. However, until only very recently, these matters have been eclipsed for several centuries by insistences on precise definitions, unambiguous classifications, unimpeachable foundations, and irrefutable logic.

Discussions of what it means to educate and to be educated haven’t been spared from these desires for universal truths, accurate measurements, context-free methods, and predictable outcomes. In university bookstores and professional libraries, the shelves set aside for texts on education are dominated by thick tomes that speak authoritatively to such well delineated topics as lesson planning, classroom management, evaluation strategies, and questioning techniques. These sorts of instrumental concerns are often broken down even further into specific technical proficiencies, which are then presented as the foundations of good practice.

Most teachers have encountered these categories of “professional knowledge” on the checklists and evaluation rubrics that are used to grade their practices. We, the authors, have a great deal of experience with such artifacts, first as public school teachers and more recently as teacher educators. More than once we have found ourselves in the uncomfortable situation of observing a teacher candidate who seems to be doing everything “by the book”—that is, who is demonstrating a thorough knowledge of how to state clear learning objectives, how to integrate all the required elements of a proper lesson, how to implement an even-handed classroom management strategy—but who is plainly ineffective. Impeccable lessons are crafted and presented, but often in complete ignorance of the contingencies of the classroom. An aim of this book is to explore the roots of this sort of disconnection.
However, the book isn’t principally about implicit beliefs or sedimented practices. Rather, there’s a more hopeful purpose. We aim to explore emergent insights into knowing, learning, and teaching for the possibilities they offer to education.

We don’t approach these topics by trying to replace one façade of confident assurance with another. Instead, we strive for a more tentative approach to the complexities of existence and education—an attitude that we have attempted to foreground with some playful uses of language. Such phrases as “engaging minds,” “knowing acts,” “learning positions,” and “teaching conditions” are used to flag an emphasis on interrogating habits of knowing while serving as reminders of the unrealized possibilities of knowledge. Interpretable both as noun phrases (objects) and verb phrases (actions), these headings reflect the necessary conditions for knowing—namely the coupled capacities to fix and unfix and to anchor one’s step in order to push into the next. In other words, this book is written from the conviction that knowledge is a dynamic phenomenon—hence the use of the gerund knowing, which is intended as a reminder that knowledge isn’t a thing.

One of the strategies used to avoid the temptation to fix knowledge is to be attentive to vocabulary and to webs of association. By way of familiar example, consider the phrase, “the business of schooling,” from which it follows that students are clients, education is a marketable service, teachers are skilled laborers, and knowledge is a commodity. This cascade of entailments can easily be extended. For instance, if one “buys into” the belief that formal education is a business, then it makes sense to demand efficiency, cost-effectiveness, quality control, worker accountability, and resource management—precisely the sorts of notions that arise to justify cutbacks in educational funding, increases in class sizes, reductions in preparation time, and the imposition of standardized tests (for both students and teachers). We could go on.

In brief, how one speaks cannot be separated from how one thinks and acts. Knowing and doing are not different phenomena.

Trees are more than an interesting thematic or a source of provocative metaphors. For instance, there is some evidence that merely having a view of trees (rather than the usual blank walls of a hospital) hastens recovery of patients. Apparently, plants can also help to reduce anxiety. There’s also evidence that “green time” can help children to focus, especially those with a history of being easily distracted.*

* See Jesse Norman, Living for the city (London: Policy Exchange, 2006).
One of the core themes of this text is that knowing always spills over the perceived boundaries of the knower. Humans are not self-contained, insulated, or isolated beings, but are situated in grander social, cultural, and ecological systems.

One rarely encounters such a strong emphasis on knowing and knowers in the most popular “How to Teach” manuals. We believe that failures to address these issues—or, more troublesome, failures to recognize them as issues at all—have supported the emergence of an educational orthodoxy that rests on some shaky foundations and an educational establishment that serves as a place to perpetuate cultural conventions rather than as a site of innovation.

At issue here is the realization that every act of knowing is partial—in the twofold sense of “incomplete” and “biased.” Knowing entails a selection, and by consequence, a discarding of other interpretive possibilities. Such selections are neither innocent nor benign. Evidence of this claim can be found in the actual impact of modern schooling: far from fulfilling the promises of benevolence and opportunity that are so often mentioned in discussions of formal education, the school has been shown to be wholly complicit in

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the maintenance of an economically stratified society in which particular domains of knowledge, particular cultural traditions, and particular social identities are given priority over others (see chap. 10).

This sort of privileging, in and of itself, isn’t the main problem. After all, knowing consists of enacted partialities. Given that human perception and consciousness are limited, it would be naive to hope for a wholesome, unprejudiced knowledge of everything. However, what is troublesome is the failure to notice the existence of these partialities. Such ignorance can allow dangerous complacencies—believing that enough is known, being comfortable with/in prevailing ideologies, not concerning oneself with the ethical obligation to be attentive to other worldviews, not attending to the impact of one’s actions on other phenomena.

At the moment, the world is witnessing some extreme consequences of such complacency. Global warming, threats of pandemics, surges in allergies, asthma, and cancers—these and other looming crises are the products of knowing. They have emerged from the ways that humanity (and, in particular, western civilization) has construed its place in the world. And herein lies another problem. At present, humanity doesn’t seem to know what to do, since appropriate responses are likely matters of knowing differently, not merely knowing more.

Returning to the point at the start of this section, knowing always spills past the boundaries of the knower. Knowing is relational; it is not just about ideational associations (as mentioned in the previous section); it also implicates the knower in webs of physical association. Knower, knowledge, and the phenomenon known can’t be separated. What one knows, who one is, and what one does aren’t distinct issues.

How does formal education configure into these webs? What is the educator’s responsibility in contributing to collective capacities to know differently, rather than merely to know more?

This imperative to know differently is a recurrent emphasis in this text. Happily, insofar as educational practice is concerned, there have actually been some promising signs of thinking differently. Recent discus-

Some plant species are rhizomatic—that is, they spread through underground shoots. For example, often all of the trees in a poplar grove are parts of a unified organism that are connected by a single root system.

These sorts of rhizomes provide a useful visual metaphor for the interconnections of certain notions. Seemingly distinct (and opposing) ideas can be deeply intertwined, even if their associations remain hidden from view.*

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Small increases in temperature, trace amounts of mercury, a bit of deforestation, moving to a single crop—these sorts of events were once seen as inconsequential on a global scale. The planet, after all, is vast.

One of the important realizations in the past half-century of ecological study has been that triggers and consequences are not proportionately related as seemingly minor environmental changes have contributed to massive ecological disasters. This insight has prompted a great deal of discussion, and it has contributed to some tremendous shifts in popular thinking about the place of humanity in the biosphere.

In particular, humanity seems to be reawakening to the fact that it is one species among many. There has also been a growing awareness of the need for systemic diversity across all levels of biological organization. There must be genetic diversity in a species, a diversity of species in a habitat, a diversity of habitats in an ecosystem, and a diversity of ecosystems around the planet. If the variation in just one of these levels is reduced, that level (and, for that matter, all the other levels) can become vulnerable.

This same sort of thinking has been more recently applied to the human realm—the ethnosphere.* A remarkable variety of cultural traditions have arisen around the world as humans have adapted their knowing to fit with contexts that include arctic tundra, equatorial jungle, prairies in the middle of continents, mountainous islands in the middle of oceans, deserts, rainforests, and so on. In each case, an emergent society—that is, a system of knowing—has arisen that is deeply rooted to place. Considered together, these systems of knowing constitute the ethnosphere—the collected wisdom of humanity, the multiplicity of ways the world has been imagined, the diversity of understandings of humanity’s place in the biosphere.

It might be argued that, in the same way that biological diversity at all levels is needed for the ongoing viability of the biosphere, so social and cultural diversity are needed to ensure the viability of humanity.

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** From Wade Davis, Light at the edge of the world: A journey through the realm of vanishing cultures (Washington, DC: National Geographic, 2002).
1.3 Diversity

As an integral part of western culture, formal schooling has been framed by assumptions about knowledge and political reality that are overwhelmingly rooted in Enlightenment empiricism and European imperialism. These totalizing influences have been so prominent that they are often taken as “the way things are.” In fact, if and when they are questioned, critiques are frequently dismissed as overly philosophical or “out of touch with what teachers really want.”

A principal intention of this book is to interrogate such assumptions and assertions. Throughout, we look to more recent trends in western thought and to diverse worldviews in the hope of prompting more complex understandings of knowing, learning, and teaching. We’re buoyed in this project by our ongoing work with practicing teachers who, consistently, have welcomed the ideas as being better fitted to the realities of their classrooms than the prescriptive and reductive legacies of empiricism and imperialism.

In contrast to those monolithic frames, one of the more prominent themes in the perspectives developed here is diversity.

Diversity is a topic at the center of discussions of indigenous peoples, whose widely varied knowledges and sensibilities have been eclipsed by western ways of knowing. Some insights of indigenous educators are particularly relevant to the intentions of this text, and so we discuss them briefly here.* We underscore at the outset that our purpose in pointing to indigenous worldviews is not to appropriate others’ insights, but to emphasize the importance of attending to the knowings that arise in diverse cultures, eras, and landscapes.

As developed in subsequent chapters (esp. chaps. 5 and 9), empirical science has been the prevailing attitude toward the production of knowledge in the western world over the past several hundred years. The pillars of empirical thought include repeatable experiments, concise measurements, and predictable results—elements whose values are clearly evident in the stunning successes of modern science.

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* For a more comprehensive introduction to indigenous education, see Linda Tuhiwai Smith, Decolonizing methodologies: Research and indigenous peoples (London: Zed Books, 1999).
An unfortunate consequence of the success and subsequent privilege of empiricism has been the tendency to position modern science as monolithic, unified, and representative of all of western knowledge. Indigenous scholars have helped to show that, in fact, western knowledge is much more diverse and conflicted than is commonly portrayed. A more appropriate image than a monolith is a bazaar of artifacts, ideas, narratives, vocabularies, icons, and texts that are drawn from many knowledge traditions and that are manifest in rules, beliefs, philosophies, and practices. These elements are simultaneously stable (held in place by constant rehearsal) and dynamic (undergoing constant modification as contexts evolve).

Even so, the inherent diversity of western knowledge and culture is rarely a matter of explicit awareness. This point is also underscored by indigenous educators, who are often cynical of the motives and methods that infuse western knowledge. For example, the tendency to think of knowledge as a commodity—that is, as a fixed and marketable thing—is a peculiarly western notion, and one that has positioned non-western cultures as sites for domination and exploitation. Another troublesome element of the western cultural archive is the tendency to regard the individual as the basic unit of knowing and sociality, out of which all knowledge and culture arise. These assumptions of independence from others and isolation from the natural world make it difficult, if not impossible, to appreciate worldviews that are rooted in notions of collectivity and connection.

The contrast between individualism and collectivity is perhaps the most significant clash between western and many indigenous belief systems.* The ethics, practices, social structures, and relations of indigenous cultures are often organized around vibrant senses of connection among people and between humans and the more-than-human world. In such contexts, knowing cannot be understood in terms of dispassionate academic exercises or production of goods for sale. Rather, knowing is about who you are and what you are doing, and it unfolds within interlaced sets of political, social, and environmental conditions.

Western education has played a prominent and troubling role in these clashes of cultures. For most of its brief history, modern schooling has been organized around the reproduction of a narrow, empiricist conception of knowledge. Indeed, schools have served not only as instruments of the empiricist attitude, but also as tools of Western imperialism.

Over the past few decades, indigenous educators have helped to foreground this issue and open it up to broader discussion. Evidence has been gathered to show how schools have been used to dismiss non-western knowledges and to systematically dismantle indigenous communities by exoticizing cultures and by forcibly separating children from their traditions.* Even though some of these injustices have been interrupted, violence continues through teaching practices and curricula that are infused by a theory of knowledge that is rooted in empiricism and imperialism, and thus organized around an individualistic and commodified conception of knowledge.

It is for this reason that the first section of this book is about knowing. Throughout we attempt to be attentive to what is taken for granted, hoping to point toward a way of knowing that is tentative, evolving, and partial—one that does not position the student as a sponge, a consumer, a mimic, or someone to be colonized, but as a participant. That is, we aim to present conceptions of knowing, learning, and teaching that move away from deeply engrained empiricist and imperialistic attitudes.

Empiricism and imperialism continuously reform themselves, so this project is a matter of ongoing struggle. At the moment, for example, teachers, school officials, and educational researchers are facing demands for “accountability” and “evidence-based practices”—notions that are rooted in empiricist science. More broadly, “globalization” appears to be serving as a new vocabulary of imperialism as multinational corporations seek to overrun economies, communication technologies disrupt local communities, and nations seek to impose ideologies. We join with many indigenous scholars as we seek to develop an awareness of the importance of nurturing diversity.

* See, e.g., Celia Haig-Brown, With good intentions: Euro-Canadian and Aboriginal relations in colonial Canada (Vancouver: University of British Columbia Press, 2006).
in biological and cultural systems. A vital site for this work is teaching.

For us, teaching is not about replication but about creating something new through moments of connecting and reconnecting with one another, with the past, and with the environment. On these interpersonal, temporal, and ecological levels, we further align this work with the scholarship of those indigenous educators who understand education in terms of the individual-and-the-collective and the-biological-and-the-cultural. It is a sense of education that does not see learners in terms of personal or cultural deficit, but in terms of the possibilities that arise when personal and cultural diversities are brought into conversation. It is an education that is not about controlling and managing, but about engaging.

Perhaps most importantly, it is an education that seeks to be attentive to the theories that inhabit its practices. As indigenous scholars around the world have helped to foreground in their critiques of empiricism and imperialism, theories contain within them techniques for selecting, organizing, prioritizing, and validating what is perceived and done. Left unconscious, theories can lock knowers into realities that are limited and limiting. Made explicit, theories can help to plan, strategize, and transform.

At the moment of this writing, the one million residents of the city of Vancouver—including the three of us (the authors), who have gathered here to discuss the writing of this book—are under a “boil-water” advisory. There’s a small risk the water supply has been contaminated by E. coli bacteria that might be clinging to huge amounts of silt washed into the city’s reservoirs during record-breaking rainfalls.

As one might expect, a focus of the media coverage is the question, “Why did this happen?” Opinions vary, but there are two points of consensus. First, the contributing factors are too complexly intertwined to enable a complete understanding of the situation. Second, despite such complexity, humans are likely responsible.

One detail has been getting considerable airplay: sometime in the not-too-distant past, government officials gave in to pressures from the forestry industry to allow the logging of significant areas around water reservoirs. The removal of the trees whose roots held the soil in place, coupled with ever more extreme weather events, set the stage for massive landslides.

And so, even as we discuss ideas that seem far removed from the ground several floors below, we find our thinking to be drawn toward the ecological consequences of human knowing. The slightly murky water that was used to make our coffee, the extra time needed to prepare lunch—these and other details remind us that smooth walls and modern conveniences present only an illusion of separation from nature.
1.4 Sufficiency

Conceptually, the two principal emphases in this book are (1) an interrogation of webs of association that shape understandings of knowing, learning, and teaching, and (2) an integration of current transdisciplinary research, with a view toward articulating possibilities for schooling that are attentive to time, context, and change.

As authors, one of the struggles we have faced in this project is finding ways to structure the presentation of information that are consistent with the sensibilities announced. For instance, when we fix the words in a published document, how can we be sensitive to issues of contingency, context, and the evolutionary nature of human knowledge? In a text that runs from start to finish, how can we highlight the limitations of linear argument?

The first of these two questions has proven particularly troublesome. In the desire to make strong claims, there is a constant danger of stating emergent insights too emphatically—that is, of representing knowing as knowledge. In the first edition of this book, we thought we had effectively dealt with the issue by being explicit about assumptions, highlighting inconsistencies, using playful vocabulary, and attending to diversities of interpretation. However, as we sat down to discuss this revision, some seven years after the original draft, we were taken aback at the errors and overstatements presented in the first edition. We have attempted to address these matters to the best of our current knowing, but we recognize that we will probably be shaking our heads at much of what we have written when we meet to discuss new insights and possibilities seven years from now.

As for avoiding the pitfalls and limitations of a linear mode of presentation, we have developed several strategies to complexify the text, four of which we will mention here. First, each chapter consists of a pair of interlaced discussions, one more anecdotal and the other more typically academic. These strands were structured to be complementary. With the exception of the selection for this chapter, the anecdotal strands
are reports of actual educational and research events, based in classrooms and other schooling contexts, and spanning a range of subject areas.

Part of our intention here was to present examples to illustrate the academic discussions, and another part of the intention was to “present ourselves.” We are teachers and researchers who live in particular places, interact with particular people, and hold particular beliefs. As we engage in discussions of knowing, learning, and teaching, we feel an obligation to represent how we are in the world.

This structure of interlaced discussions might also be justified in terms of some recent research into human memory. As developed in more detail in chapter 4, cognitive science researchers typically identify two sorts of conscious long-term memories: episodic (event-based, autobiographical, and narratively structured) and semantic (fact-based, rote, and often lacking an integrated structure). The former tend to be more stable and more easily recalled than the latter—hence the effectiveness of the ancient teaching practice of embedding factual knowledge in rich images and narratives. This deeply rooted teaching practice (and not the recent cognitive research) prompted us to structure the chapters as we have, but it’s comforting to know that cutting edge scientific inquiry supports a pedagogical practice that reaches back into antiquity and stretches across cultures.

Another feature of the writing is the use of the margins. We wanted to take advantage of these spaces to highlight, elaborate, and occasionally digress. This feature is actually prompted by a few pedagogical principles, including the need to provide opportunities to take short rests from the text and the desire to re-emphasize matters of particular relevance.

As for references, in a significant departure from the first edition, we have incorporated footnotes in places where we have felt some readers might want to have access to more information. We have been very selective in this regard, focusing on accessible and comprehensible references that, for the most part, have good reference lists themselves. If you are interested in more detail and in more rigorous discussions,
you should be able to find them through the citations provided.

This approach to referencing is not typical of academic texts where the more common practice is an extensive bibliography. We wanted to avoid the artifice of authority that sometimes goes along with a long reference list. Our intention is not to impress or validate but to invite others into the further play of ideas. We thus felt it appropriate to constrain choices. Presenting a long list is often no more helpful than presenting no list at all.

Another reason for this strategy is a belief that knowing has a networked structure—a point that is developed in more detail in chapters 4, 5, and 11. We see this book as a node in that network. The aim is thus to use the referencing strategy to provide access to the grander web of knowing, not to attempt the impossible task of presenting a comprehensive mapping of that web.

Finally, a fourth strategy for interrupting linearity is perhaps more subtle. Rather than conceiving of the text in terms of discrete and sequential steps in the development of an argument, our approach to structuring this book has been to think in terms of nested discussions that loop back onto themselves at various levels. This point is perhaps more easily made with reference to the images presented at the start of each chapter. In a sense, each of the twelve chapters, each of the three parts, and the book itself ends up where it begins.

As discussed in subsequent chapters, a nested structure and an iterative (looping back) dynamic are important aspects of knowing, learning, and teaching. We thus thought it would be an interesting challenge—an enabling constraint (see chap. 11)—to organize a text according to some of the principles it presents.

But more importantly, we wanted the text to embody a principle of knowing that is at the heart of the writing. A knower’s knowing is subject to constant modification; yet at the same time, one’s sense of the world is curiously adequate. In spite of the partiality of knowing, one is typically unaware of gaps in understanding and perception. That is, knowing has a certain sort of vibrant sufficiency.

* See, e.g., Humberto Maturana & Francisco Varela, The tree of knowledge: The biological roots of human understanding (Boston: Shambhala, 1987); Francisco Varela, Ethical know-how: Action, wisdom, and cognition (San Francisco: Stanford University Press, 1999).
Of course, when the image of a tree is introduced into a discussion of knowing and education, it is almost inevitable that the topic of apples will come up. Newton’s apple has become the symbol of sudden insight, Eden’s apple is a metaphor for the perils of knowing, the apple image is used more than any other to introduce the alphabet (“A is for …”), and the apple on the corner of a desk is a popular reminder of the relationship between student and teacher.

On a grander level of interpretation, the modern apple tree is a sort of living record of recent human history. Most of the apples that are sold in supermarkets are hybrids of Asian and European varieties, reflecting cross-fertilization of not just plant varieties, but civilizations over past centuries. Moreover, in its engineered flavor and texture, as well as in its size and unblemished surface, the supermarket apple bears traces of intertwined historical events and social movements, including industrialization, urbanization, capitalism, and modern science.

It’s all there, in a single apple, sitting on the corner of the teacher’s desk—a phenomenon that can only be understood when locating it in a complex biological-and-cultural matrix. The apple is indeed an apt symbol of knowing and knowers.

In contrast, much of contemporary educational practice is organized around an assumption of static deficiency—that is, a belief that learners are more-or-less fixed beings with inadequate understandings. In such a frame, the task of education is to complete them.

As we will endeavor to develop in the pages that follow, an education that is oriented by the principle of vibrant sufficiency is very different. One must be mindful of how one frames knowledge, since those frames influence one’s understandings of learning and teaching. Concisely, knowing frames.