

Stability

Creating Flexible, Temporary, and Adaptive Learning Structures

System learning structures are flexible, adaptive, temporary, and responsive to new learning.

RECENTLY LEARNED ABOUT A CLASS OF FIFTH- TO eighth-grade special education students who were asked by their local community to tackle a civic problem: the need to change a road pattern in the community so the local airport could add a runway. These ten to fourteen year olds threw themselves into the project with great energy: they carefully crafted the problem statement and decided what they knew and needed to know. Then they explored multiple issues related to wetlands in the area, took surveys of businesses and home owners along the existing and proposed route, did extensive traffic counts, studied the number of accidents at a dangerous Y intersection, pored over maps from their state's department of transportation, and invited state transportation officials to their class to share information and answer questions.

At the end of their project, the students presented their recommendation to the state department of transportation, proposing that

the existing road configuration be changed from a Y to a T. Because this would require cutting down many trees, they also recommended that two trees be planted for each one cut down. The officials listened attentively, thanked the students for their thoughtful proposal, and told them that they were not required to replace trees that they cut down.

Two years later, the students read a news story on the front page of the local newspaper: the state department of transportation had finally decided what to do about the road: they were going to change the configuration from a Y to a T, and replace two trees for every one they cut down!¹

Learning is a process of exploration and discovery. It thrives within contexts and conditions (structures) that stimulate and encourage our pursuit and construction of meaning. How and what we perceive, think, and hold as truth is shaped by the multiple contexts and structures within which we continuously learn. Cultural norms, peers, the Internet, and the media often immerse us in shallow contexts for learning. However, to sustain a vibrant democracy, the context of formal learning must ensure that deep thinking is nurtured in a culture of inquiry and imagination.

Despite all the other competing contexts in which we learn, our homes, our communities, and our schools are the dominant environments and places where our learning self is initially defined and often solidified. If we do well in school and are praised and rewarded for being “smart,” we carry this affirmed and confident learning self into everything we do. And if we do not do well in school and are ignored or marginalized for not being “smart,” we carry this demeaned and shamed learning self with us as well, a silent and invisible albatross that diminishes our future learning capacity. We become afraid, tentative, and risk averse. Learning becomes unnatural.

It is within this context of defining the learning self that the structures of schooling have their greatest potency for mind shaping. Within living systems, structures are the physical embodiments of the system’s identity and patterns of relationships and the visible and temporary forms created to sustain it. While patterns are qualitative and invisible, structures are quantitative and tangible. In healthy living systems, structures are continuously adapting and changing. When meaningful information challenges its current forms, it must adapt to sustain its deeper purpose. Old structures are no longer able to hold

the new self being formed. This emergence of new or modified structures keeps the system alive.

LEARNING CHANGES *the* STRUCTURE *of the* BRAIN

Structural adaptability (plasticity) is also true of the human brain as we learn. Our brain is a complex adaptive system. Although we do not know the extent to which the brain changes as a result of experience (learning), or the role of cultural contexts in brain shaping, we do know that the interplay between genes and experience influences the unique shape (the networks of connections) of our brains.² Each person's combination of intelligences is therefore uniquely configured.

If learning influences the structure and organization of our brains, then the nature and quality of the environments in which learning

Beliefs That Ground Generative Learning and Schooling Structures

- *Learning is demonstrated, assessed, and credentialed by multiple forms of evidence* and by exhibitions and performances of deep understanding, anytime and anywhere. Learning time is variable. Learning is assessed whenever the learner is ready and credentialed when the learner demonstrates learning. Learners actively participate in the assessment of their own and their peers' learning.
- *Rigorous, meaningful, reliable, and legitimate assessment of deep learning is dynamic, flexible, and systemic.* It includes both quantitative and qualitative evidence of understanding. It is self-correcting and ongoing and is demonstrated in authentic contexts and settings that enable complex responses.
- *Meaningful curriculum must be connected to the learner's lived experience, the community's needs, and the world's problems.* Life must be the curriculum for schooling.

occurs are crucial. Our brain's search for meaning is innate. Because meaning is constructed through patterning and because deep understanding is more likely encouraged in challenging inquiry-based environments and thwarted in fearful or threatening ones,³ we must design learning conditions and structures that are congruent with how we learn and that stimulate our natural desire for learning. Such environments are messy, ill structured, highly interactive, imaginative, "seriously" playful, and brain and learning compatible.

Deep learning is profoundly relational. It is all about engagement and meaning. Deep learning occurs when children create a relationship between themselves and what they want to learn, between themselves and their peers, between themselves and their teachers, and between themselves and their communities. Learning structures must actively encourage these learning relationships. They must be mutable, adaptive, and responsive to new information. Currently they are not. We lack relational contexts for knowing, relational strategies for teaching, relational curricula for meaning making, relational assessments for understanding, and relational learning environments for belonging.

Schooling systems and their learning and teaching structures are connected webs of relationships. Their components of curriculum—instruction, assessment, and professional development—have no meaning devoid of the whole and the context within which they are embedded.

GENERATIVE STRUCTURES *of* SCHOOLING ARE FLEXIBLE *and* ADAPTIVE

So too with the structures of schooling. They must flow from the principles and processes of what we now know about living systems and learning. This means they must be flexible and adaptive to the changing needs of learners and learning environments. The current structures of schooling, largely manifested through historically mandated, nonadaptive, and rigid frameworks of curriculum, instruction, assessment, and professional development, were designed using erroneous principles of human learning and profound misconceptions of the conditions essential for deep understanding. As a consequence, these structures are irreconcilable with our natural ways of learning and the

creative and exploratory processes of life itself. The results? A prescriptive, uniform, and often incoherent curriculum that is unchallenging, overly saturated with facts, fragmented, and lacking in disciplinary and interdisciplinary depth, relevance, connections, and meaning. Nonadaptive and formulaic instructional approaches rooted in efficient and detached transmission. And a depersonalized, competitive, punitive, and high-stakes testing system that is nondiagnostic and disengaged from the learners' need for continuous and immediate feedback on their own learning.

These fragmented and immutable structures mark the current environment of learning. Now, however, we have the knowledge to create learning and teaching structures that nurture creative inquiry, experimentation, innovation, and deep learning. These environments:

- Do not abandon standards. They establish relevant, coherent, and meaningful expectations for significant student learning designed to develop integral habits of mind.⁴
- Do not abandon formal curriculum. They redesign it so children engage with the concepts and inquiry strategies of multiple disciplines by using their modes of inquiry to solve real-world problems within the community.
- Do not abandon instruction. They transform it to enable teachers, students, mentors, and practitioners to actively engage in cocreating knowledge and inquiring together.
- Do not abandon evaluation, measurement, and assessment. They create multiple indicators and strategies for securing continuous feedback and evidence (both formative and summative) on the quality of their children's learning.
- Continuously share this learning information with the children so they develop their own internal learning authority.

These environments do not abandon the structures of learning and schooling that are essential for disciplined meaning making; they redesign them in concert with the generative identity, information, relationships, processes, and patterns of life. No longer is an externally created, one-size curriculum, instructional strategy, or assessment system mandated for all. These structures are informed by external contexts,

but they are created by the system and are continuously evaluated, adapted, and changed as new learning and information emerge. Buoyed by these adaptive and more personalized structures, children feel connected. They know what they need to learn and why, and they are able to imaginatively explore and continuously learn anytime, anywhere, and in any place. Generative structures for learning are congruent with the process of life. Our brains are structurally flexible and spontaneously adaptive. The processes of learning must be as well. The identity we choose and the processes we design create the system dynamics that shape our organizational structures.

The SYSTEM'S IDENTITY MUST GROUND ITS STRUCTURES

In generative learning and schooling systems, structures are explicitly designed to enable the system's fundamental learning identity, learning information, learning relationships, and learning processes and networks to become manifest. Structures embody the system's learning expectations and commitments. If we begin a systemic change process by first trying to change structures, the structures not only drive system identity; they become the system's identity. We water the structural leaves of schooling, but that nourishment never reaches the deepest roots of learning.

This understanding is fundamental to designing a radical new system of schooling: *the system's identity must ground the design of its structures, not the other way around.* The first step is to cocreate a clear, coherent, and compelling identity around deep learning; only then can we design generative structures that embody our purpose. Deep learning is more likely stimulated and nurtured in natural learning systems—a network designed according to the ways life organizes itself for sustainability. How a system is organized has enormous influence on its capacity to become and live its purpose. In healthy and vibrant learning systems, structures are adaptive and can re-form as the system discerns new possibilities, new interpretations, and new expressions of self.

We commonly make two fundamental errors when it comes to trying to impose systemic change: we forget we are engaging with life, and we fail to remember that we are part of a dynamic, interdepend-

ent, self-generating system. That's why we so often fall into the engineering and efficiency trap and think we have to start with structural change. Either we begin our organizational change efforts by thinking we need to fix the structure, or we conclude our change efforts with structural changes as the final dimension of our work. Perhaps it's because structures are the most visible part of schooling and their visibility suggests immediate attention, but based on what we understand about how transformation occurs in living systems, it is both the wrong place to begin and false security to believe change will ever be finished.

The POWER of GENERATIVE LEARNING STRUCTURES

Within a schooling system, there are numerous structures that manifest the system's purpose and embody its patterns and processes for doing its work. The crisis of meaning emerging from our current system of schooling comes from its identity and design as a deficiency-based and remedial model of learning that has become calcified in rigid, permanent, and disconnected structures out of sync with the creativity and adaptability of learning. The new system is profoundly different. To illuminate its distinctions, we'll focus briefly on three schooling structures: curriculum, instruction, and assessment.

Many important books have been written in recent years about each of these structures. My purpose is not to reiterate what has already been advanced. Rather, it is to name the principles of generative and life-affirming design essential to manifesting the new story and system of learning and schooling within each of these three structures. These patterns and design principles create the language and map from which the new learning and schooling terrain will emerge.

Before we explore each of these components, I'd like to share a personal story that exemplifies the power of intentionally designed generative learning structures to invite and evoke deep learning. Several years ago, I attended a conference designed to challenge perceived learning and capacity boundaries, stretch awareness of our unexplored and unknowable potentials, and invite a new learning identity and sense of self. In opening the conference, the leader raised four questions and asked the group to respond by raising our hands. These questions were:

- How many of you can't sing?
- How many of you can't write?
- How many of you can't paint or draw?
- How many of you can't dance?

There were two hundred adults in the room, and everyone raised their hands at least once. She followed this question with two more: "Where were you and how old were you when you first learned what you could not do, when you first learned that you could not sing, or write, or paint, or draw, or dance, or?"

I recalled the woman who told me she hadn't sung since the third grade, not even in the shower. Now, with sadness, I realized that in third grade, I had learned that I could not draw or paint, and I had not done so since that time.

Everyone had his or her own story, but the pattern was unmistakable: each of us had learned in school (mostly by fifth grade) what we could not do. I particularly remember the young woman who "couldn't write," married a writer, and then even stopped writing Christmas cards. But then something unfolded that felt magical. For the next four days, we practiced doing what we believed we couldn't do. We sang passionately with a skilled singing coach. We wrote creatively with a renowned writer. We painted freely with a gifted watercolor artist. And we danced almost effortlessly. Some of us thought our "products" needed much more work, and others were astounded at how good they really were. But it didn't matter. We had been invited into a place we had never been except when we were very young, and it provoked a fundamental shift in who we were now and who we saw ourselves to be as learners. We clearly could do what we had believed for years we could not.

The conference leader had brilliantly designed generative and life-affirming conditions and structures that enabled each participant to reconnect to what had been severed and lost. Through trusting coaching relationships with experts; immersion and practice in writing, singing, dancing, and painting; slow time; and emotional reconnection with who we were becoming, we were transformed as learners. The young woman who "knew she couldn't write" has since written several children's books.

How smart are we really? How capable are we really? The truth is, we have no idea. The power of learning invitations and conditions to shape learning identity and performance is profound.

We turn now to three defining process structures: curriculum, instruction and assessment, and the design principles that enable us to create their generative learning terrain. We begin with curriculum.

*A CURRICULUM for LIFE IS ALL
About LOVING the QUESTIONS*

I first encountered the construct of curriculum for life in the writings of Howard Gardner and Veronica Boix-Mansilla.⁵ Using this context, they named several universally human questions they believed children must actively engage in in order to deeply understand their world and their connections to it. I offer their questions as a context for the new curriculum:

- *Identity and history:* Who am I? Where do I come from?
- *Who is my family?* What is the group to which I belong? What is the story of that group?
- *Other people, groups:* Who are the other people around me, and what other parts of the world do they live in? How are they similar to and different from me? How do they look? What do they do? What is their story?
- *Relations to others:* How should you treat other people? How should they treat you? What is fair? What is moral? How do you cooperate? How do you handle conflicts? Who is the boss, and why?
- *My place in the world:* Where do I live? How did I get there? How do I fit into the universe? What will happen to me when I die?
- *The psychological world:* What is my mind? Do others have minds? Are they like mine? What are thoughts, dreams, and feelings? Where do my emotions come from? How can I handle them? How do I remember things? How do I communicate?

- *The biological world:* What about other creatures? What does it mean to be alive, dead? Do animals think? What about plants? How are animals related to one another, to the world of plants, to humans? Is there a substance of life? How is it created?
- *The physical world:* What is the world made up of? Why do things move? What do we know about the sun, the earth, the stars, the water, the rocks—their origins, their fate?
- *Forms, patterns, sizes:* Why do things look and feel the way they do? What regularities are there in the world? How do they come about? What is big, biggest, and how can you tell?

After I read these questions, I became curious about some of the questions my own faculty was asking our students. Table 10.1 lists some “big questions” IMSA faculty embed within our curriculum.

For some, these questions may appear far too soft and lacking in disciplinary coherence and complexity to constitute a formal and rigorous curriculum. But deeply exploring really good questions can take us into the depths of disciplinary, interdisciplinary, and transdisciplinary thinking and problem solving. Knowledge generation is provoked by inquiry—by truly great questions whose exploration profoundly illuminates and deepens our understanding. It is the truly great question that captures our sense of wonder and imagination and invites us to discover the essence of who we are, why we are here, how we come to know, and how we belong. Great questions are portals to a future of unknown possibilities. Several years ago, I was asked by an interviewer, “If you could, what’s the one piece of advice you would give to all students?” My answer was simple: “Ask questions that matter. Ask questions that make a difference. Ask questions that you love so that as you live your life seeking the answers, you will find joy.”

For schooling to be generative and life affirming, the curriculum must tell a coherent, connected, and powerful story of wholeness, meaning, connections, and belonging. It must tell the story of our oneness with the universe, with the web of life, with the web of human experiences, and with each other. It must help children discover and tell their own story. In a relational universe, all of life is connected.

TABLE 10.1. *“Big” Questions for Deep Learning*

<i>The Four Pillars of Learning</i>	<i>“Big” Questions for Deep Learning</i>
Learning to know	<p>What does it mean “to know”?</p> <p>How do I come to know the natural world and my place in it? What is the system of which we and life are a part?</p> <p>What are the dimensions of reality, and how do we come to know reality? What constitutes the “real world”?</p> <p>How can we know our own mind or the world outside our mind?</p> <p>What do we mean by “truth”? What is a “fact”? Are there “fixed truths” or values, or are human actions and endeavors culturally relative?</p> <p>What is the relation of us-as-observer to that which is observed? How do we characterize the interface, and what about some possible results of such a connection?</p> <p>How can we tie the present to an unknown, rapidly changing future?</p> <p>What do we currently believe that is probably wrong?</p> <p>We are our history, so who are we?</p> <p>How do things work in the physical world? What are the implications and responsibilities that come with this knowledge?</p> <p>How do we know what we know? What is the relationship between public knowledge (that which society recognizes as “true”) and private conscience (that to which one has a personal commitment)?</p>
Learning to do	<p><i>How</i> have I learned what I know?</p> <p>What am I eager to explore, invent, and discover?</p> <p>How do I most enjoy solving problems and resolving conflicts?</p> <p>What kinds of questions and challenges do I want to devote my life to?</p>

TABLE 10.1. *“Big” Questions for Deep Learning, Cont’d.*

<i>The Four Pillars of Learning</i>	<i>“Big” Questions for Deep Learning</i>
Learning to be	<p>Who am I? What are my assumptions? How do my assumptions affect what I know, what I believe, and what I do or don’t do?</p> <p>What is my work, and how is it living out? How do I make sense of my environment? How does what I know and do come together to define my worth?</p> <p>What do I believe in, and why do I believe it?</p> <p>What is consciousness? What is the mind? What is specifically human about our minds?</p> <p>What is sacred?</p> <p>What is important in life?</p> <p>What am I willing to die for (or live for)?</p> <p>Are there absolutes in my life, or in life? If so, how can they be discovered?</p> <p>What is life all about? Why are we here? What do I believe in? What must I fight for, and what must I fight against?</p> <p>What is my place on this earth—for now, for the next few years, forever? What is my story?</p>
Learning to live together	<p>How do I sustain the belief that I can leave the world a better place?</p> <p>How can I learn to live and work with others? How do I relate to others?</p> <p>What is my relationship to the natural world, the universe, and its inhabitants, and so what?</p>

Our children do not know this timeless story and therefore do not know they are an essential part of its wondrous evolution. A curriculum for life ensures that the deeply human story embedded in the richness, complexity, beauty, and unity of knowledge is experienced by our children.

FIVE DESIGN PRINCIPLES *for*
a CURRICULUM *for* LIFE

What principles might we use to design a curriculum for life that engages children in the human questions necessary for deeply understanding the world and their place in it? We must ensure:

1. *The curriculum is centered on real-world problems framed by the learner's prior knowledge and lived experiences and the community's and real-world's needs.* Grappling with complex and compelling questions and relevant and meaningful ill-structured problems engages the learner's passion, curiosity, and imagination in trying to make sense of the environment, figure things out, and develop a sense of his or her own efficacy and power as a learner. The curriculum for life makes this encounter with life possible and connects children to their growing identity as self-directed learners.

2. *The curriculum is based on inquiry and structured around essential questions embedded in the human experience.* Learning experiences grounded in the organizing principles, core concepts, and modes of inquiry and truth verification that uniquely define each disciplinary domain promote mindful investigation, knowledge generation, and critical thinking. Understanding the principles and concepts within a domain illuminates its patterns and brings coherence and meaning to its knowledge and theoretical claims.

3. *The curriculum is integrative—explicitly and continually linking principles and concepts within, across, between, and beyond disciplinary domains.* Discerning connections enables children to see the fundamental unity, patterns, and relationships of knowledge. Curriculum experiences that engage students in individual and collective reflection allow them to create meaning, discern wholeness, and internalize a sense of belonging and connection. It is important to note, however, that deep interdisciplinary and transdisciplinary understanding and application are not fully possible without deep disciplinary understanding. Our children simply cannot connect what they do not know.

4. *The curriculum is competency driven—focused on developing the habits of mind and being (higher-order thinking and perceiving)*

internalized by thoughtful practitioners. This is made possible when children are immersed in continuous practice within and across disciplines. For example, we frequently hear educational slogans that promote science (it could be any discipline) *for* all students. The curriculum for life carries a decidedly different message: it says science and scientific thinking *by* all students. If children are not actively engaged in the doing of a discipline, the solving of a problem, the writing and acting of a play, or the creation of a product, they remain observers of life and cannot participate in its cocreation. Multiple and rich opportunities for immersion in doing the work of a domain are essential for mindful inquiry.

5. *The curriculum activates and honors the unique potentials of each child.* When generative and life-affirming conditions are created for our children's learning, their goodness and genius will astonish us.

Complex problem resolution is more likely when children have been immersed in complex learning experiences that call them to engage their multiple potentials to discern and connect the dots. This is enhanced when we teach children about systems of all kinds and engage them in systemic thinking. This systemic mental model offers them a dynamic and connected map for discerning often hidden patterns and interconnections. Understanding our kinship with life and living systems is an imperative not only for the planet but also for human health and well-being. Our children must understand that they are a part of the web of life and their behavior either enhances or diminishes the web's vitality and sustainability.

TEACHING *for* UNDERSTANDING

The story at the beginning of this chapter illustrates the excitement that can be generated when we teach for understanding. The fifth graders whose research influenced the actions of their community recognized that to resolve the problem they were confronted with, they had to understand its complexities. This high school-age student reflects on the value of the deep understandings made available through problem-based learning:

Imagine you are in a course for the first time, expecting a traditional classroom setting. Instead of your instructor attempting to spoon-feed you information, she says you are part of a risk assessment panel and your duty is to determine the best location to build a super theme park in Southern Illinois. Or perhaps there is a hurricane threatening the coast of Florida, and it is your responsibility to issue warning and evacuation plans to keep the population safe. Wouldn't this experience be far more exciting than a typical class and motivate you to take responsibility for your own learning? Problem-based learning requires a student to experience intellectual frustration, witness firsthand the power of collaboration, and deal with ambiguity. These skills will continue to gain importance in our increasingly complex global society.⁶

Teaching is one of those endeavors that intrigues and often confounds us. "What exactly do great teachers *do*?" is often a question we ask. Is teaching an art or a science, or is it an integration of both? What is the role of a teacher in an environment designed to foster personalized learning, inquiry, and deep understanding?

An IMSA math teacher who teaches a course entitled Mathematical Investigations (MI) offers the following response. I quote it in its entirety because it so beautifully captures the answer to these questions:

To an MI observer, teaching an MI classroom looks like a teacher's dream job . . . very little at-the-board "lecture" on some days, and instead, the teacher is milling about the room, looking over students' shoulders, and intermittently asking or answering questions. Even first-time MI students sometimes wonder, "When is the teacher going to "teach"?"

But looks can certainly be deceiving! Teaching MI is far more exhausting than preparing lessons and lecturing could ever be. In the traditional format, the teacher is almost always in control of what happens next; everything is predictable, planned, and polished. There is often a sense of "I taught it, so they now know it" that follows. Unfortunately, there is little way to actually validate that sense until a formal assessment is given, and by then, it's way too late for some kids.

The word "teaching" takes on a whole new meaning in the MI classroom. It goes well beyond standing at the board and dispensing

content, methodologies, and algorithms organized in a manner that makes perfect sense to the well-educated (and well-meaning) teacher. It now means letting go, *listening*, *assessing*, responding, questioning, probing, *listening*, clarifying, watching, *listening*, guiding (but not just telling), and *assessing* EVERY student, EVERY day. There is a delicate balance of timing that must be maintained of when to let the students grapple with a new or difficult idea, and when to intervene, help them make necessary connections and “see the big picture.” There is a constant need to “think on your feet” as students ask questions that even the seasoned teacher does not anticipate. There is a need for enough self-confidence and mathematical understanding to let the students watch YOU grapple with a challenging problem so that they can see you as a model problem solver, even if that means you make a mistake in front of them (something that the traditional teacher wouldn’t dream of). There is a need to be able to answer students’ questions with questions that lead them to the answers they thought they couldn’t get. There is a need to hear the misconceptions that truly underlie their initial response—“I don’t know how to do this one.”

And once you think you’ve mastered all of that, you get a new class of students, and you have the grand opportunity to start all over again. You find the balance again, perhaps in a different place; because all students are different, and teaching MI actually lets you see that and react to it. The MI teacher has the gift of hearing students talk about the mathematics in their language, using their constructs. You learn to read how each student in your class thinks about mathematics, and you have the privilege of adjusting your instruction to suit all of those needs; that is simply impossible in a traditional classroom. Results on formal assessments are rarely surprises; such tests are merely opportunities for the students to demonstrate their knowledge in a more formal manner.

What does the MI teacher do? Oh. Not much!⁷

Her response tells me that Parker Palmer had it just right: teaching is a profound and constantly unfolding and evolving integration of what he calls the “tangles of teaching.” These tangles, he says, have three sources: the need to deeply understand the content of what we teach; the need to deeply understand and wisely respond to the individual, social, and emotional complexities of our children; and the

need to understand who we are as teachers. “We teach who we are,” Palmer says. “Good teaching requires self-knowledge. . . . The human heart is the source of good teaching.”⁸

Teaching who we are is illustrated by another IMSA teacher:

If we are to develop ways to make active student discovery happen, take hold, and endure, we must define who we are in the classroom. A teacher who facilitates discovery, who creates the environment that makes discovery possible must realize it is not an environment only for students, but that the interrogative mood includes the teacher as well.

It is not enough to ask questions that evoke responses. One could do that all day and cover nothing but fact. The teacher must raise questions that genuinely puzzle the teacher.

Facilitating discovery is the ultimate intellectual exposure because the way to encourage thinking is to be thinking yourself.⁹

Many years ago, as a brand-new sixth-grade teacher, I faced my ultimate intellectual exposure during an encounter with students I never anticipated. We were studying the fascinating culture of the Bushmen of the Kalahari desert as part of our world history unit. I had designed the class to be highly interactive. Students were working in teams—very uncommon thirty-five years ago—and the curriculum was largely *National Geographic* magazines and encyclopedias, not textbooks. The children appeared quite captivated and fascinated by this remarkable culture, and I felt everything was going according to plan.

Then one day, when one of the teams was presenting their research, a student blurted out, “I know you won’t like this, but I don’t believe the Bushmen really exist!” Half the class laughed. The other half stared in silence. I was stunned. I wondered how he could possibly have gotten this idea. Hadn’t he remembered reading *National Geographic*? Hadn’t he remembered seeing all the pictures of Bushmen? How could he believe they didn’t exist? I didn’t know then what made me do what I did next, but in looking back, I can see that it was the beginning of living into the new story for me. I looked around the room, where all the pictures of the U.S. presidents were hanging. I grabbed the picture of Abraham Lincoln, tore it off the wall, ripped

it up, and said, “Jamie, I am *so* glad you said this, because I never believed Abraham Lincoln existed either!”

The class went berserk—accusing me of everything from ignorance to insanity, including lack of patriotism. When they finally settled down, I asked everyone to pick up a chair, move it into a circle, sit quietly for a moment, and think about what had just happened. I then invited them to comment if they wished to—one at a time, so we could all really listen to one another. Amid all of their eleven- and twelve-year-old emotions of disbelief and outrage toward me and the student who had started this, emerged something I wasn’t expecting: a deep and passionate desire to really know. My actions had thrown them off, completely destabilizing their world. They thought they knew how to decide if something was true and who to believe. But now they weren’t sure. I had taken away an illusory safety net.

The next day we began a very different conversation. We talked about truth and how we know something is true when we cannot see it or are not there. We asked countless questions:

- What exactly is truth?
- Can something be true at one time and not another? Who decides?
- What experts should we believe? What are reliable sources that we can trust?
- How can we verify what experts say?
- How do historians arrive at saying something is true?
- How is it different from scientists?
- How shall we decide if the Bushmen really do exist?

From that moment, I had different children in my classroom. The questions had engaged their curiosity and their passion, and they became skeptical and thoughtful inquirers—an essential disposition for lifelong learning. They read the newspaper differently, listened to their parents and me differently, and, most important, asked each other different questions: How do you know? What evidence have you gathered and from whom? How have you verified it? Their laser-like

intensity astounded me. They had begun a learning journey they would continue for the rest of their lives.

FIVE DESIGN PRINCIPLES *for* TEACHING *for* UNDERSTANDING

What principles might we use to design instruction so that our children experience teaching as a relational, cocreative, and live encounter with great questions and great ideas and so that their hearts and spirits are welcomed in learning? We must ensure that teaching is:

1. *A relational, personal, communal, and transformative process of cocreation between teachers and learners.* Teachers and learners are deeply and often playfully engaged in mindful and challenging investigation—in safely wondering together, cocreating meaning, and experiencing the unfolding mysteries and revelations of the natural world and the human experience. They improvise together, experiment together, seek novelty together, play together, risk together, and create new truth together. The climate is challenging and engaging but not threatening.

2. *Focused on ensuring that each student acquires knowledge, develops an understanding of disciplinary and interdisciplinary concepts and knowledge structures, and learns a broad repertoire of critical and analytical thinking, reasoning, and inquiry strategies that enable her to process and make sense of what she has learned.*

3. *Personalized and grounded in fostering each learner's construction of meaning through exploring prior knowledge, uncovering preconceptions and assumptions, and actively engaging each learner's unique constellation of intelligences.*

4. *Centered on the personal and communal exploration of great questions and the creative framing and resolution of complex and ill-structured problems and issues relevant and meaningful to the learner.* Teaching must create a safe practice field for dynamic inquiry, innovation, and playful exploration. Great teaching is teacher designed and student directed.

5. *Developing each child's confidence and internal authority for lifelong learning.* Great teaching must ensure children have the metacognitive skills and strategies necessary to assume control over their own

learning. This includes discerning and correcting their misconceptions, understanding their strengths and how they learn best, monitoring their own learning goals, and assessing their own understanding.

Great teaching for great learning is clearly not only about what we are asking our children to learn; more important, it is about *how* we are asking our children to learn. Again, Parker Palmer's insights are profoundly important: "Every way of knowing becomes a way of living. . . . Every epistemology becomes an ethic. . . . Every mode of education, no matter what its name, is a mode of soul-making."¹⁰ To this I would add, every epistemology gives rise to a pedagogy: how we teach is based on how we believe we come to know.

Ensuring this quality of teaching is learned and sustained requires vibrant communities of practice—professional learning communities that are also competency driven, inquiry based, problem centered, and integrative.¹¹ These dynamic and collaborative partnerships and networks enable teachers to explore teaching practice, exchange and challenge instructional strategies, collectively analyze and use student learning data, and engage and support one another in innovative systemic change. For far too long, teaching has been an isolated act. Closing the classroom door has often meant closing the door to meaningful dialogue, peer observation, reflection, and deep learning. We must create conditions that encourage and sustain communities of practice.

Within IMSA, for example, there are two process structures for enhancing instruction and professional practice. One is a "call for dialogue" (optional), and the other is annual faculty presentations. A "call for dialogue" can be issued by a faculty member at any time and is open to anyone in the community. While these calls vary, they provide an opportunity for professionals to engage one another in non-evaluative conversations about teaching and learning. Typically, calls for dialogue center around faculty candidly describing a lesson that didn't seem to work and asking for feedback on what they might do differently. Calls for dialogue are not mandatory workshops on best practice. They are collegial and voluntary inquiries about professional practice and its impact on student learning.

Faculty presentations offer similar opportunities for learning and exchange. Faculty prepare brief written abstracts of what they will present in a thirty-minute time frame. Abstracts are compiled and dis-

tributed ahead of time so faculty can choose the sessions they wish to attend. Here are several examples of abstracts to give you a sense of what is shared.

Assessment of Mathematical Investigations-2 Exams

After an exam on matrices in Mathematical Investigation-2, I videotaped three students presenting their solutions to two problems. The aim of this work was to gain a better understanding of how well students are able to demonstrate their understanding of mathematical concepts on timed written exams. I will show portions of the videotapes and discuss what I have learned.¹²

An Experience with Projects: Balancing Structure and Flexibility

My Mathematica class offers a challenge to create assignments that are challenging, possible for all, and grade-able. I have made some progress in my ability to create and define these projects, but there's still plenty of room for improvement. I will share some of my goals, my attempts, and the results. (Note: It is not necessary to know anything about Mathematica or even much of anything about mathematics to follow most of my presentation).¹³

Changing My Spots

I've always known that I am intimidating to students—they bluntly tell me so on each student survey. But I couldn't figure out exactly why they see me this way. Last year when doing an unrelated study with my students, they unexpectedly helped me discover several of my behaviors which they see as intimidating. This year I have been making a concerted effort to change these behaviors. I'm still not seen as Mr. Snuggly, but this year's student surveys sure read differently.¹⁴

Using Student-Generated Rubrics to Improve Student Performance and Encourage Metacognition

Students usually want to do their best; therefore, I am always looking for ways to clarify expectations without being overly prescriptive.

Adapting an idea from my colleague, I asked French III students to develop an assessment rubric for a culminating oral presentation of a unit on Francophone poetry. I will show the process in which students engaged, provide copies of the final rubric, and show one or more video clips of the oral assessment. Performance has consistently improved for all students.¹⁵

I have attended many of these presentations, and they have been powerful. When peers decide to become vulnerable to one another and authentically and nondefensively share their practice and their questions, profound insights can emerge and thinking, and behavior can change.

Schooling systems that intentionally design time and space for the creation and sustainability of communities of practice and reflective inquiry invite a vital and self-correcting practice field for continuous and meaning-filled professional learning.

ASSESSMENT GENERATES CONTINUOUS FEEDBACK *About* STUDENT UNDERSTANDING

In living systems, feedback (assessment) is neither a monster nor a process and structure to be feared. Quite the contrary: living systems are sustained through the flow of continuous and abundant information about their learning purpose.

Learners, schools, and the systems of which they are a part also require continuous, abundant, and transparent information about their learning. However, our current obsession with only one kind of feedback—annual performance and ranking on national and state high-stakes achievement tests, often unconnected to the curriculum—completely distorts the natural and essential purpose of feedback, which is to deepen student understanding by illuminating knowledge and conceptual insights, and gaps and misconceptions. By mechanizing its procedures, granting indefensible high stakes to its conclusions, inaccurately interpreting the meaning of its results, and not questioning the consequences of its totally quantitative and comparative test scores, we allow these standardized and once-a-year multiple-choice tests to “distribute” student achievement along a bell-shaped

curve and “define” the learning, potential, and success of our students and the competence of our teachers.

If it were not so tragic, it could be viewed as an astounding act of hubris—believing we could actually create a one-size-fits-all assessment system to definitively and conclusively determine the achievement and promise of each one of our children, without asking them to actually demonstrate their knowledge and understanding in multiple ways over extended periods of time. But its unintended and insidious effects linger long past the years of formal schooling, and they cast an ominous shadow over the minds and hearts of our children. Years of hearing labels like “failure,” “underachiever,” or “slow learner” become internalized so deeply that a new “deficient” learning self emerges—one who no longer sees possibilities or promise, but sees only peril and the need to protect its fragile self.

Our children crave meaning-filled, honest, continuous information about their learning, given within the context of an affirming and respectful environment designed to help them succeed through the ways they learn best. In such an environment, there is no one right way to learn or demonstrate learning proficiency and no one-size assessment to fit all students. Every child is unique. Our instructional work is to create personalized learning conditions that develop the potentials of each child. Our assessment work is to create multiple assessments—including tests—that enable each child to demonstrate his or her learning proficiency and mastery. In such a system, there is no normatively prescribed achievement distribution. Everybody can get an A.

FIVE DESIGN PRINCIPLES *for* ASSESSING DEEP LEARNING

What principles might we use to design generative assessments and assessment systems that are congruent with our children’s need for continuous and meaningful feedback (information) on their learning that will provide evidence of deep understanding and integral habits of mind and will sustain their learning over time?

We must ensure that assessment for deep learning is:

1. *Generative (ongoing and cyclical) and focused on continuously deepening learning and understanding by teaching children how to monitor and regulate their own learning and that of their peers.* Assessment is a natural and essential process of learning, but the structures we have designed—largely summative, norm-referenced, high-stakes tests—do not serve this self-monitoring purpose. In high-stakes testing, students are detached recipients, not engaged collaborators. Students must actively participate in monitoring, regulating, reflecting on, and assessing their own learning. All students must have the opportunity to deeply learn a core of essential knowledge and organizing principles within and across domains. However, how that knowledge is assessed must be driven by their unique potentials and ways of knowing. Students have input in designing assessment rubrics and are encouraged to demonstrate their understanding in ways that are compatible with how they learn best.

2. *Coherently and explicitly integrated within curriculum and instruction.* Generative assessments cannot be separate evaluation structures disconnected from the curriculum in which our children are engaged. We must assess the curriculum we ask our children to learn.

3. *Structured so all learners can demonstrate their learning when they are ready through multiple forms of evidence that encourage them to integrate knowledge across disciplines.* These include public defenses, performances and exhibitions, concept maps, mathematical and scientific models, musical and artistic products, software programs, diagrams, problem logs, Web pages, learning journals, or integrative learning portfolios.

4. *Meaningful, reliable, valid, fair, and transparent.* Assessment must not only be useful to the system in adapting and adjusting curriculum and instruction, but it must provide learning information meaningful to the learners, their parents, and the community.

5. *Diagnostic, ongoing, flexible, and systemic.* Assessment for deep learning must include objective and quantitative assessment, as well as personal and qualitative evidence of understanding. It must also be self-correcting and be demonstrated in authentic contexts and settings that enable complex responses. Superficial, one-time, ranking, and sorting-based evaluation is not a sound measure of deep learning or understanding. It does not provide evidence of the depth and quality of a student's understanding and does not allow him or her to demon-

strate interdisciplinary and transdisciplinary connections. Generative assessments are not one-time snapshots; they must enable patterns of learning proficiency to emerge. Multiple assessments must provide a picture of each learner's development and performance over time, and reliable and valid evidence of the system's desired learning outcomes. Advances in computer-adaptive assessment may lead to a far more meaningful and personalized system of assessment and instruction. By adjusting the difficulty and complexity of test questions each child receives according to his or her proficiency level in responding, adaptive assessment illuminates patterns of understanding that can serve as a map for further learning and teaching.

REDESIGNING OTHER CRITICAL STRUCTURES

Other critical learning and teaching structures must also be flexibly redesigned if the new story is to become manifest. These include structures of:

- Learning space and location (within the school and within the larger community)
- Learning time, not seat time (schedules, learning year)
- Grading, monitoring, documenting, and reporting student and system learning to students, parents, and the community
- Student advancement and credentialing
- Mentoring, advising, coaching, and personalized learning
- Student clustering for collaborative, intergenerational learning
- Stimulating innovation and experimentation
- Parental and community engagement in learning
- Recognitions and celebrations of learning

Designing these structures to create the new learning and schooling landscape will require fundamental reconceptions. Rigid schooling structures cannot drive generative learning purpose. Adaptive, personalized, flexible, and responsive structures enable learning to thrive. Rigid schooling structures are the “boxes” we are often told to “think outside of.” But this admonition carries an assumption that the boxes

are basically sound. Maybe they are not. If all of us are consistently encouraged and challenged to think out of the box, perhaps there is something fundamentally wrong with the box.

Table 10.2 depicts in condensed form the profound differences between the landscape of the current prescriptive and uniform story of learning and schooling and the generative and life-affirming new story. (For a more complete story, see “The Two Stories of Learning and Schooling Contrasted” at the end of the book.)

LEADERSHIP INQUIRIES *About* LEARNING and SCHOOLING STRUCTURES

Creating generative learning and schooling systems means engaging our communities in deeper questions about learning and schooling structures. I offer the following questions to get you started:

- *How have I experienced great learning? What learning conditions—curriculum, instruction, assessment, time—encouraged and invited it? As a system, what must we invest in to build our capacity to create these conditions for our children? What would our children say if we asked them when and how they experienced great learning? What does our system feel like to our students, teachers, parents, and community?*

- *What are the nature and quality of the learning experiences and structures that are more likely to nurture integral and wise minds? What experiences can we create and embed in our structures that connect children to themselves, others, and the natural world so they feel a sense of connection and belonging? How do our current structures support personalized, engaged, and active mind shaping?*

- *What flexible and adaptive structures might we create to become a living learning laboratory for integral teaching, integral schooling, and integral leadership? What might we do to dislodge the structural constraints on our system’s learning and creativity? What learning, teaching, and governing structures must we now reimagine in order to create another way? How might we create more time for deep learning for reflection, innovation, discovery, and creation?*

- *What current structures are stifling our system’s capacity and our capacity to learn deeply and develop internal learning authority, create and experiment, and actively engage in developing the fullness of our children’s and our own potentials? What must we do to ensure our learn-*

TABLE 10.2. *The Current Reductive Story and the New Integral Story: A Synthesis*

	<i>The Current Reductive Story: Prescriptive and Uniform Transaction</i>	<i>The New Integral Story: Generative and Personalized Engagement</i>
Mental model of learning and schooling	Deficiency and memory: analyzing, “fixing,” and remediating identified learning limitations; accepting external authority for learning	Abundance and meaning: activating, developing, and connecting unknowable learning potentials; developing internal authority for learning
Learning identity	Passive acquisition and pragmatic compliance; short term	Purposeful and transformative engagement; lifelong
Learner identity	Disengaged and conforming recipient: receive inert information	Active and inquiring cocreator: construct meaning
Teaching identity	Transmitter: convey preselected information; dispenser	Mentor: weave deep understandings; cocreator
Learning information	Static and limited: externally prescribed, controlled, and perceived as irrelevant	Dynamic and abundant: externally responsive, self-generated, accessible, and imbued with meaning
Learning relationships	Contractual: individualistic, competitive, and fear based	Collaborative: inclusive, interdependent, and trust centered
Learning processes	Mechanistic: acquisition based and risk averse	Creative: inquiry based and exploratory
Learning patterns	Prescribed and hierarchical: fragmented—focused on parts	Self-generated and networked: holistic—focused on the whole
Learning structures	Immutable and standardized: permanent and nonresponsive to new learning	Flexible and adaptive: temporary and responsive to new learning
Quality of minds	Reductive: shallow, fragmented, and rigid	Integral: holistic, connected, and resilient

ing and teaching structures are and remain adaptive, flexible, and mutable? What are the silos that exist in our system, and what can we do to offer them another way? What are we measuring in our system? What does this cause us *not* to measure or notice? How might our current infrastructure systems—human resources, finance, legal, facilities, security, and so on—become more adaptive and flexible so they better manifest our purpose and connect our work?

