

Chapter 1

Reinventing Schools

It's Time to Break the Mold

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The Case for a Fundamental Change

The U.S. education system is under fire for many reasons, including these problems:

- mediocre student performance in relation to other countries
- low scores on standardized tests for too many of our children and schools
- inadequate preparation of students for college
- substandard focus in STEM areas (science, technology, engineering, and math)
- great inequities in the quality of education for many disadvantaged children

Policymakers and educators have been trying for decades to solve these problems by reforming schools, with disappointing results. Their approach has been to make reforms that leave the basic structure of the education system intact. But could that very structure be the source of the problems?

MEETING THE NEEDS OF ONLY A FEW

We propose that most schools in the United States are not designed to meet the education needs of students. It's a bold claim, right? How can schools not be designed for learning? That's supposed to be their whole gig.

Consider the setup of our current system:

- All students in a class are essentially taught the same material at the same time. The rate of progress is tailored to the middle performers in the class.
- Slower students seldom master all the material being taught, creating learning gaps that compromise the future learning of these students.
- The primary purpose of tests is to compare students to each other, rather than to compare student performance to a standard of achievement.
- To avoid criticisms of “grade inflation,” teachers often limit the amount of time a student has to take a test. This also makes it easier to distinguish brighter students from slower ones.
- Student report cards track courses and grades. They don’t indicate what a student has actually learned—or still needs to learn.

Here’s what people involved with schools have to say about this current state of affairs:¹

Samantha, a bright high school student:

I get bored in school. I don’t have any choice about what to learn. There are lots of things I want to learn, but I have to learn stupid stuff in school. I can’t learn about things that are important to me [in school], so I use Google a lot at home. I just do enough in school to get by.

Jeremy, a failing middle school student:

I hate school. Some kids are mean to me. The only good thing is I get to see my friends [at school]. I don’t get much of what my teachers talk about, and, like . . . well, I just tune out most of the time. My teachers don’t care much about me.

Robert, a seventh grade teacher:

I became a teacher because of Mr. Parker, my seventh grade teacher. He cared about me and made me want to do well. I wished I had more teachers like him, so I decided to become a teacher. But I get really frustrated. It’s hard to get to know my students because I have 124 of them, and I only see them for 40 minutes a day. Just when I begin to get to know my students well, they move on to eighth grade. Plus, I need to spend so much time preparing them for the standardized test that it’s hard to do things that can really excite them and make a difference in their lives. I bring my work home, but I have two children now, and I feel torn between them and my students. I just feel burned out. A nine-to-five job sounds really good to me now, but this isn’t a good time to be looking [for a job].

Sarah, a parent:

I have two children in school, a girl in first grade and a boy in fourth. My son does well with structure; he needs to be given specific tasks and deadlines, and then he does well. But I’m really worried about Alicia. She is in a world of her own. It takes her a long time to do anything. But she’s really bright and creative. She reads a lot and knows how to add small numbers, but she doesn’t like to be rushed. She likes to do things well and likes the satisfaction of finishing things. Her teacher is forcing her to hand in work before she can finish it, and Alicia gets very frustrated about this. I’m afraid she’s going to start hating school. Worse yet, she’ll begin to hate the idea of learning. Her teacher and principal are both very polite, but nothing has changed. I wish I could have more influence over the way my daughter is being taught.

Steven, a business leader:

I’m very concerned about our schools. I own a small pharmaceutical business, and the young people I hire tend to lack initiative and work ethic. I’m also disappointed in these employees’ low ability to solve problems and work on teams. I’ve tried to address these problems with our school superintendent, but I can’t get anything to change.

A state legislator:

Our schools need to be more competitive globally for our economy to be strong. Since schools aren’t improving on their own, we need to force them to improve. We have set higher standards for them to meet, and we are holding their feet to the fire. But we’ve been doing this for six years now, and I’m worried that it just isn’t working. I don’t know what else we can do.

Clearly, today’s schools aren’t perfect, but what makes us think they are not designed to meet the education needs of students? For starters, consider one of the few things that practically everyone—educators, parents, and even students—agrees on: Children learn at different rates and in different ways, and individuals have different learning needs. Yet schools typically teach a predetermined, fixed amount of content in a set amount of time.

In this rigid group-learning structure, within each classroom, slower learners like Jeremy and Alicia are forced to move on before they have learned the content, so they waste a lot of time and accumulate gaps in their learning that make it more difficult for them to learn related content in the future. Meanwhile, faster learners like Samantha become bored to frustration and waste a great deal of valuable time waiting for the class to move on, instead of forging ahead to new topics and skills. Holding back quick learners while others catch up squanders talent that communities and businesses sorely need.

MEETING THE NEEDS OF ALL

To meet the needs of all students, an educational system must allow for continuous progress for all students. It must not force students to move on before they learn current material, and it must not hold back faster students while the rest of the class catches up. Schools could take a cue from the Boy Scouts, an organization that knows how to ensure that people master practical, real-world skills. Scouts work on a merit badge until they achieve it, and then they move on to the next merit badge. Individuals progress through ranks based on their achievements, not time.

Time-based student progress forces achievement to vary—forces some students to be left behind. Time is the constant, and learning is the variable. The alternative is *attainment*-based student progress in which learning is the constant and time becomes the variable. This approach gives each student the amount of time needed to reach the standard for competency. A system designed for learning has the following characteristics:

- It does not force a student to move on *before* a certain standard is met.
- It allows a student to move on *as soon as* the standard is met.

This is a huge (bold!) difference—a *paradigm change*. And it is a change to a *true* standards-based approach to education, in contrast to a system that expects all students to reach the same standard at the same time.

DEATH OF THE CARNEGIE UNIT

The Carnegie Unit, also called the credit hour, was established in the early 1900s as a standard measure of student learning. One unit represents 120 hours of class or contact time with a teacher at the secondary level. The Carnegie Unit is the standard for all course credit in schools and universities. While it is intended to indicate amount of student learning, it really measures seat time.

The Carnegie Foundation for the Advancement of Teaching, which conceived the unit, received funding in 2012 to explore ways other than time to measure competency.

This funded project is an important indicator of growing recognition of the need to change from time-based student progress to learning-based progress. Furthermore, replacing the Carnegie Unit with a true measure of learning could do much to accelerate the transformation of education to a design for learning.

WHAT IS A PARADIGM?

The term “paradigm” applies to all sorts of topics, including the following examples:

Lighting: Paradigms of lighting include the flame (candles and whale oil lamps), the electric light bulb, and the light emitting diode (LED).

Transportation: Paradigms include foot travel, boats, horses, railroads, automobiles, and airplanes.

Family: Family paradigms include the tribal family, the extended family, the nuclear family, the single-parent family, and the dual-income family.

Education: Paradigms of education include the one-room schoolhouse, the current time-based factory model of schools, and the attainment-based system.

Piecemeal change: This is a change within a single paradigm, whereas *paradigm change* is change from one paradigm to another.

Although this learning-focused paradigm represents a bold change for schools in the United States, it’s probably familiar to most people—not just the Boy Scouts. It’s the way people naturally learn. This is the structure used in computer gaming, in which players must keep working on one level until they master it and unlock the next level. Mastering one level before moving on to a more difficult level makes sense. Moving on before mastery is a recipe for failure, but it is an inherent part of the structure of the current time-based paradigm of education. If we truly want our schools to reach and teach every child, then every child needs the opportunity to master a skill at one level before moving on to the next level of complexity.

PREPARING STUDENTS FOR OUTDATED BUSINESS NEEDS

Some people blame teachers for the problems in today’s elementary and high schools: “Those darn unions are standing in the way of good education.” Others blame school leaders: “We just need a better principal in charge here.” Some blame parents: “Parents aren’t disciplining their kids or making them do homework.” Still others blame students: “They’re lazy and don’t care.”

A close and thoughtful look may reveal that the lion's share of blame belongs to the *structure of the system*, not to its people. For an educational system to adequately prepare students to succeed in the world in which they live, the system must reflect the realities of the society in which it's operating.

Our current *paradigm* of schooling is often called the "factory model" and was developed for the Industrial Age, from about 1830 to 1960, when factory work had replaced farm work as the most common means for earning an income in the United States.

Think about the time long before factories, during the Hunting and Gathering Age, when a whole tribe was responsible for educating young people to improve their odds of survival. Then consider the change that occurred in the Agrarian Age, when most people lived and worked on farms. The one-room schoolhouse, along with tutorial instruction and apprenticeship, replaced that early form of education. Children needed basic math and reading skills to function in a farming community. There were no grade levels, no courses, no standardized tests. The community needed a learning-based system, not lock-step instruction on a fixed timetable. Older kids often helped younger ones.

WAVES OF CHANGE IN SOCIETIES

Alvin Toffler identified three major waves of change that triggered huge paradigm change in all sectors of society:

The *Agricultural Revolution* transformed society from hunting and gathering to agriculture.

The *Industrial Revolution* transformed society from agriculture to manufacturing.

The *Information Revolution* transformed society from manufacturing to knowledge work.

Toffler describes how each wave has brought huge changes to all aspects of life, including what he calls the techno-sphere (which produces and allocates wealth), socio-sphere (allocates roles to individuals), info-sphere (allocates information to make the other spheres work), and power-sphere (exercises power).

Education has changed paradigm with every one of these societal changes.

Now consider the Industrial Age. In transportation systems, railroads replaced boats for most transportation of goods, and horses gave way to cars. In the workplace, factory jobs surpassed farming jobs in number. In communications, the telegraph, telephone, and radio replaced the town crier and pony express. And in education systems, the one-room schoolhouse transformed into the age- and grade-specific factory model of schools that is still being used today.

To prepare children for factory jobs, schools needed to teach students to comply with instructions and discipline. The most important lessons were not part of the explicit curriculum; they were the "hidden curriculum"—what Alvin Toffler, author of *The Third Wave*, calls the "covert curriculum." Here are the lessons related to this curriculum:

- *Obedience*: Do what you're told to do (sit down and be quiet).
- *Punctuality*: Complete your tasks on time.
- *Stamina*: Get used to doing boring, repetitive tasks.
- *Standardization*: Get on pace with your peers to learn the same things in the same way at the same time.

In the Industrial Age, most people worked on assembly lines doing mindless tasks over and over again. Employers didn't need or want employees to have refined thinking skills. Therefore, educating all students to high levels was unnecessary and undesirable; it was also too expensive for most public education systems.

What employers did need was for the education system to prepare the majority of students for factory jobs and filter a smaller percentage of students to prepare to go on to higher education and become managers and professionals. The Industrial Age educational system was a great fit; it efficiently sorted students, separating those suited for manual labor from those more naturally suited for management or professional work.

In essence the Industrial Age paradigm was designed to leave many children behind. We can never succeed at NCLB as long as we keep the Industrial Age paradigm of education, with its time-based student progress that forces many students to move on before they really learn the material (i.e., master the standards).

The sorting function is also served by the grading system. Teachers often grade "on a curve" and thereby adjust student test grades depending on how well the group performs on the test. This means some students get As and others get Fs, regardless of the grade that the actual percentage of correct and incorrect answers warrant. This is known as "norm-referenced" testing in some circles (see Paradigms of Testing box).

PARADIGMS OF TESTING

Norm-referenced tests are intended to compare students with each other. A grade indicates how well a student performed compared to the other students in a class. Therefore, a B in biology may represent a very different level of performance in one school versus another.

In contrast, *criterion-referenced* tests are intended to validate that a student has reached a certain standard of competency. Grades indicate how much material on a topic a student learned.

At the dawn of the Industrial Age, complete paradigm change in education happened because communities changed dramatically—from a focus on farming to a focus on factories—and this caused a fundamental change in educational needs, including the hidden curriculum and higher levels of literacy and numeracy skills.

The United States is now a postindustrial society that is different in fundamental ways from an industrial society. Are these differences so dramatic that they have created another fundamental change in our educational needs? If so, then once again, we would need a *paradigm* change in education.

EXPLORING THE ESSENCE OF THE INFORMATION AGE

The work and educational needs of a nation during the Industrial Age were shaped by the prevailing technology of the time: machinery. Key characteristics of the Industrial Age include standardization, uniformity, adversarial relationships, bureaucracy, autocratic leadership, control, compliance, professional service, and compartmentalization. We explore each of these characteristics in this section and point out how they're different in today's information-based society—and what the changes mean for education and preparation for life.

Standardization to Customization

At the height of the Industrial Age, when the United States had the most workers in factories, our society was dominated by mass production (the assembly line), mass communication (newspapers, radio, television stations), and mass marketing (advertising via mass communications). Standardization was the name of the game.

REDEFINING THE ACHIEVEMENT GAP

The achievement gap is generally thought of as the gap between high- and low-performing students. This reflects industrial age thinking in which the intent is for all students to achieve the same competencies at the same time. Given that students learn at different rates, this inevitably requires holding back faster learners.

In information age thinking, the achievement gap is about the difference between how much a student is learning and how much that student *could* be learning. The highest goal for equity is to help all students reach their potential. That is the way to truly “leave no child behind.”

Henry Ford commented about the Model T, “You can have any color you want, as long as it’s black.” Now, however, the Information Age is epitomized by Pandora’s personalized radio that customizes songs based on each listener’s preferences. Customers today demand custom products to meet their individual needs and preferences. Cell phones, Facebook, and Twitter offer increasingly powerful tools for customized communications. “Cookies” in your Internet browser give companies powerful insight for customizing marketing. In every facet of our lives today and across every industry, standardization has given way to customization.

Yet schools are seldom based on customization. Students in the same class are typically required to learn the same things at the same time and rate. Also, all teachers have typically received the same professional development at the same time, regardless of whether they had already learned it or whether the training was relevant to their needs (though this has begun to change as our society evolves deeper into the Information Age). Standardized tests tend to assess all students in a given grade on the same competencies at the same time. For the most part, public elementary schools and high schools in the United States are still standardized, not customized.

Uniformity to Diversity

At the height of the Industrial Age in the 1930s and 1940s, most people tried to blend in. If you look at a picture of a busy city street at this time, you see that many people dressed the same way, drove cars that looked the same (the black Model T!), and had the same kind of haircut. But this isn’t how groups of people look and behave anymore! Now you see tremendous variation in the way people dress, what they drive, and how they wear their hair.

Uniformity has given way to diversity in most aspects of life, particularly in academic and workplace situations. Employers now see diversity of perspectives and skills as a huge advantage.

Similarly, the student mix in today's classrooms is more diverse than ever; thus, individuals in a classroom learn in ever more different ways and rates. That's okay, because the job market requires people to have many more different kinds of skills. Yet, for the most part, even with the recent interest in differentiated instruction and response to intervention (RTI), public elementary schools and high schools in the United States still focus on uniformity. Rather than embracing and promoting diversity, teachers expect all students in a class to learn the same things at the same rate.

Adversarial to Collaborative Relationships

People often think of competition as the alternative to collaboration. However, it is not competition that's giving way to collaboration in today's communities. Competition is neither less important nor less common in the Information Age than it was in earlier times. If anything, competition is intensified by global markets and a greater variety of choices for consumers. But *adversarial relationships* are giving way to collaborative relationships for success in the Information Age.

For example, in the Industrial Age, labor strikes were common; relationships between workers and employers were typically adversarial. Labor strikes are much less common now. Since knowledge work has replaced manual labor as the most common form of work, companies are recognizing that their most valuable asset is the knowledge that their employees possess. Competent knowledge workers are more difficult to replace, so companies are increasingly investing in their employees' professional development, building trust, and treating employees well. In 2010 alone, private companies spent \$52.8 billion on employee training.²

Adversarial relationships were also common in schools during the Industrial Age. Teacher strikes were fairly common then, and the relationships between teachers and students were—and still are—typically perceived (by many students at least) as adversarial, as captured in movies like *Ferris Bueller's Day Off* and song lyrics like “Hey, teacher, leave those kids alone.” In fact, some teachers even purposely withhold information from students to see who can figure out answers on their own.

Sheer class size also abets the adversarial vibe. High school teachers typically have 100–150 students in a semester that they see in batches of 25–30 for about forty minutes a day. The inherent anonymity that this situation fosters means adversarial (instead of collaborative) relationships prevail.

And what about the relationship between teachers and parents? They're often adversarial, too, in the Industrial Age education system, especially student-teacher and teacher-administrator relationships. Many parents feel unwelcome in their children's schools, and many teachers feel frustrated with parents' lack of involvement or support, though this is beginning to change in some schools. Finally, the relationship between school boards and administrators is often adversarial as well in the current system. Many school boards demonstrate a lack of faith in administrators by micromanaging through strict oversight.

Some of these Industrial Age features are beginning to change in some places, but unfortunately many school systems nationwide are still generally characterized by adversarial relationships—not the more productive collaborative ones. Education systems will become increasingly dysfunctional until the core relationships among students, teachers, parents, administrators, and governing bodies transform from adversarial to collaborative.

Bureaucracy to Teams

Bureaucracy was the most common organizational structure for decision making in the Industrial Age. But bureaucracy tends to be very slow to make decisions because it takes time for information to work its way up the various levels of a bureaucracy and for decisions to then work their way down to the “front lines.” But, really, this system worked fine when the pace of change was relatively slow. That's not the case in today's world of round-the-clock, instant communication. The Information Age brought rapid change to the marketplace, so companies that respond slowly are at a potentially fatal competitive disadvantage. To become more agile, companies are forming relatively autonomous teams that have latitude to make their own decisions but are held accountable for their performance.

Similarly, the Industrial Age paradigm of education was (and still is) characterized by consolidation into large school districts managed by bureaucracies. This makes it difficult for teachers to respond rapidly to the changing needs of the increasingly diverse students in their classrooms. Movements toward site-based management, shared decision making, and team teaching reflect a growing recognition of the need for our bureaucratic education systems to take a page from the business world's playbook and transform into team-based organizations.

Autocratic to Shared Leadership

Bureaucratic organization tends to be autocratic or dictatorial. This structure assumes that the people at the top of the bureaucracy are the most qualified

individuals to make good decisions for the entire organization. And this worked fine when frontline workers were performing very simple jobs, but that's no longer the case. For complex and rapidly changing knowledge work, frontline workers are often the most qualified individuals to make critical decisions about product design, production, and marketing. Shared decision making and leadership can put some organizations at a significant advantage over their more traditionally structured counterparts.

Similarly, in the world of education, with an increasingly diverse student population, an ever more complex array of technological tools to support learning, and a growing need to customize learning experiences for students, shared decision making is the way to go. Teachers, parents, and students themselves can benefit as never before from being part of decisions about teaching and learning.

Centralized Control to Autonomy with Accountability

Bureaucratic organization, autocratic leadership, and standardization are all powerful tools for centralized control, and they are all systemically related to, and supportive of, each other. This *interdependence* of key characteristics is inherent to any paradigm. But one can have bureaucracy and autocratic leadership in autonomous units. So this is a different characteristic from the others, though it's related. The growing problem is that centralized control in large systems requires bureaucracy, and bureaucratic organization works too slowly to deal effectively with the increasingly rapid rate of change.

Team-based organization requires distributed control, or *autonomy*, but teams must be accountable for their performance. According to Thomas Malone, a shift is occurring in the workplace from "command and control" to "coordinate and cultivate." You can get a sense for what this means by thinking about corporate restructuring efforts that eliminate middle levels of management and replace layers of centralized control with teams that have a large degree of autonomy and accountability for their performance.

U.S. public education systems are still characterized by centralized control. The larger the system, the more centralized the control. But different schools in a large district tend to have very different demographics and thus different kinds of students with different needs. Equity used to be thought of as treating all students the same, but now with high levels of diversity, equity requires people to treat students according to their needs. Centralized control does not promote flexibility for educators to treat students differently according to individual needs. The movements toward site-based management, shared decision making, and charter schools all reflect some recognition of a need

for schools to have more autonomy for the means and be held to greater accountability for results.

Compliance to Initiative

In the Industrial Age, it was important for those working on an assembly line to follow directions. Compliance was an important part of the "hidden curriculum" in schools. Students were expected to sit down, be quiet, and do what they were told to do; students who didn't behave according to these expectations did not succeed in this education system.

A school board member who was the founder of a tool company in Richmond, Indiana, mentioned that he used to be able to hire a high school dropout, show him how to use a lathe, and know the employee would probably work out well. Now, he said, he needs to hire people who can work well in quality circles and have good communication and problem-solving skills.³ He needs employees who take initiative to solve problems and improve processes, not people who wait around to be told what to do.

Changing the hidden curriculum of our schools from compliance to self-direction and initiative requires fundamental changes in the structure of educational systems.

Professional Service to Self Service

In the Industrial Age, an attendant pumped your gas, a porter carried your suitcases, an accountant prepared your taxes, and so forth. Now technology makes it easy to pump your own gas, wheel your own suitcases, prepare your own taxes, check out your own groceries, conduct banking transactions, and much more. Self-service has become the norm in many spheres. Similarly, Alvin Toffler wrote about the "prosumer" in the Information Age as someone who is simultaneously the producer and consumer of a good or service. For example, Wikipedia is a kind of user-produced encyclopedia. It is updated by users and available to all—for free.

In education, learning is still overwhelmingly "delivered" by professionals (teachers), even though the Internet in general and Google in particular have made self-serve learning much quicker, easier, and less expensive than even the do-it-yourself books that became so common just a few decades ago. *Open educational resources* are free, self-serve, learning tools on the Internet that enable people to learn almost anything. The availability of no-cost valuable resources has huge implications for education, but these tools are frequently unavailable for use in today's schools. Most schools greatly

restrict Internet access, and most limit students to a small set of websites on a small number of computers available at limited times.

Compartmentalization to Holism

A common characteristic of bureaucratic organizations is division into departments. Businesses typically have departments for product development, production, marketing, sales, finance, and purchasing. Similarly, governments, hospitals, universities, and even large law firms are organized into departments. Local school districts follow this model, too. The central office has departments in large school districts, and even the content for learning is usually divided into subject areas (math, science, social studies), despite the interdisciplinary nature of the real world.

However, as business experts Michael Hammer and Michael Champy point out, corporations are finding that by “reengineering” their processes, they can significantly improve their efficiency and effectiveness. Process reengineering typically involves (1) creating a “case team” with members from each of those departments to cover all the skills needed, and (2) having the team conduct the entire process together. This greatly reduces the time, errors, rework, and expense for each performance of the entire process. Hammer and Champy found that a case-worker-based process (which is holistic) typically operates ten times faster than the assembly-line version it replaces (which is compartmentalized), and it also generates fewer errors.

Information Age schools have found several ways to reengineer the educational process for each student. One way is to create a case team made up of all students’ teachers. Another is to have one teacher serve as a student’s guide and mentor for all grade levels that are taught in the school. Examples of some of these innovations are included in chapter 3.

The Information Age is far more complex than the Industrial Age. This complexity applies to virtually all systems in society: the economy, governments, businesses, financial systems, healthcare systems, transportation systems, communications systems, and, yes, educational systems. Solving problems today requires an understanding of “system dynamics”; people need to know how things are interrelated. A holistic or systemic view of the world has huge advantages. Whereas compartmentalization was fine for a simpler, mechanical age, it does not get the job done today. Mechanistic thinking often entails an either/or (reductionist) perspective, but systemic thinking entails a both/and (expansionist) approach.

Table 1.1 lists some of the key differences between the Industrial Age and the Information Age. This side-by-side comparison highlights general ways the paradigm of education needs to change to meet the current needs of students, organizations, and communities.

Table 1.1. Comparison of Key Characteristics of Two Ages

<i>Industrial Age</i>	<i>Information Age</i>
Standardization	Customization
Uniformity	Diversity
Adversarial relationships	Collaborative relationships
Bureaucratic organization	Team organization
Autocratic leadership	Shared leadership
Centralized control	Empowerment, accountability
Compliance	Initiative and self-direction
Professional service	Self-service
Compartmentalization (Division of labor)	Holism (Integration of tasks)

CHANGING EDUCATIONAL NEEDS OF STUDENTS

The educational needs of students have been particularly influenced by the changes in the key characteristics shown in table 1.1. Here are some of the major changes in student needs:

1. *Knowledge work.* Manual labor has given way to knowledge work as the most common type of work today, just as manual labor replaced farm labor as the most common form of work during the Industrial Age. This means that many more students need to be highly educated today versus fifty years ago for the United States to compete with knowledge workers in other parts of the world, including India and China. In 2004, the United States graduated about 70,000 undergraduate engineers, compared to India’s 350,000 and China’s 600,000. In a “flat” world in which graduates compete with knowledge workers globally, only those who are best prepared for knowledge work will have the best standards of living.
2. *Complexity.* Everything has become more complex than it was in the Industrial Age or Agrarian Age. Financial systems, communication systems, and even entertainment systems are more complex now than they were in the past. Just try going into a friend’s house and using their TV! Performing in today’s world requires much higher levels of education—and a different kind of education (such as higher-order thinking and problem-solving skills)—than it did in the Industrial Age.
3. *Systemic thinking.* Systemic thinking and understanding the dynamic interrelationships within various systems are important for effective civic education, yet the current educational system decontextualizes

and compartmentalizes the real world into discrete subject areas without addressing their powerful interrelationships. For example, many factors influence how much oil we consume in the United States: the international price of oil, how cold the weather is, automobile mileage requirements, attitudes about global warming, availability of alternative energy sources, taxes on oil consumption, and much more. Focusing on any single aspect of this issue reveals a flawed and incomplete picture.

4. *Diversity of skills.* Whereas teaching everyone the same things served people well in the Industrial Age, developing students with the same set of skills no longer makes sense for a job market that requires so many different kinds of knowledge and skills. Cultivating students' individual talents will better meet their needs and their communities' needs than forcing them all to try to learn the same things. This is different from sorting students, because sorting entails teaching all students the same things at the same rate, so slower students flunk out. Here, students are taught different things, depending on their talents and interests. Of course, much common knowledge is still important.
5. *Collaboration.* Businesses and other organizations need employees who can work well with others on a team, communicate well, and resolve conflicts. Part of the hidden curriculum in the Industrial Age was "don't collaborate; that's cheating." It was tough to compare students if they helped each other learn. In the Information Age, the hidden curriculum must foster collaboration.
6. *Initiative.* Employers need people who take initiative to identify and solve problems, even in manufacturing environments. Part of the hidden curriculum in the Industrial Age paradigm is "sit down, be quiet, and do what you're told to do." Compliance is the goal. That made sense in the Industrial Age, because companies needed compliance on the assembly line and in the bureaucratic hierarchy. But knowledge workers need initiative and self-direction.

Given these new educational needs, *everyone* needs higher levels of education to attain a good quality of life. A school system that's designed for sorting students is no longer making the grade. Now, a complete focus on learning is critical for ensuring that every child reaches his potential, rather than relegating a majority of children to a narrow range of opportunities. Schools that foster systemic thinking, problem solving, diverse skill development, collaboration, and initiative are far better suited to prepare students to be happy and productive in today's complex and competitive world than is the current paradigm.

But don't take our word for it. These new needs are so great that multinational corporations and educational organizations came together in the Partnership for 21st Century Skills to identify ways of meeting the new needs. In addition, studies by the Department of Labor (the Secretary's Commission on Achieving Necessary Skills), the National Center on Education and the Economy (New Commission on the Skills of the American Workforce), and the National School Boards Association's Center for Public Education agree that these new kinds of skills are essential for all in U.S. society today.

Piecemeal reforms in our education systems are the norm, the go-to action, making it easy to overlook paradigm change, a kind of change that is unfamiliar and more challenging. During the Hunting and Gathering Age, the paradigm was education by the whole tribe ("it takes a village to raise a child"). During the Agrarian Age it was the one-room schoolhouse and apprenticeship or tutorial instruction. During the Industrial Age it's been the factory model of schools. Each of these paradigms has its own key characteristics that served the world in which it operated.

From this larger perspective, it stands to reason that *paradigm change must and will eventually take place in education* as we move deeper into the Information Age. An outdated educational system cannot adequately prepare students to succeed in the real world no matter:

- how much money is invested in training teachers to perform outdated techniques;
- how high the stakes become for students to perform on standardized tests;
- how low the student-to-teacher ratio becomes;
- how much competition is inflicted on public schools by charter schools and vouchers; and
- how much technology is integrated into classrooms.

A system designed to hold back the brightest students, leave behind those who need more time, and prepare all students for a world that no longer exists cannot continue to be the predominant paradigm of education.

Examples of the Information Age paradigm of education do already exist (see chapter 3); they're just not yet the most common paradigm, and they need further development.

Understanding the S-Curve and Paradigm Change

Paradigms have a common pattern of development known as the "S-curve," so it's possible to see where the new paradigm of education stands. This may

seem a bit technical, but knowing about the S-Curve helps to see the nature and challenges of paradigm change, which are very different from those of piecemeal reforms.

Paradigms in the Industrial Age were considerably more complex than in the Agrarian Age, and those in the Information Age are more complex than they were in the Industrial Age. For communication systems, the Internet and cell phones are far more complex than radio and the telephone, which in turn are more complex than the pony express. And for education, the learner-centered paradigm is far more complex than the current factory model, which in turn is more complex than the one-room schoolhouse.

All types of systems evolve to ever-greater complexity: biological, communication, transportation, education, and so forth. This evolution of *classes* of systems (paradigms) to ever-greater complexity counterbalances the process of decay of *individual* systems into simpler components (called entropy); it's the yin and yang of all systems in the universe, the creative force and the destructive force. For example, retailing organizations have become considerably more complex in the Information Age, with companies like Amazon and Costco using complex operations and advanced technologies. While retailing has evolved to much greater complexity, individual companies that have not evolved have died off, such as Woolworth and Service Merchandise.

So how does a system develop? Consider the airplane. When it was first developed, it couldn't do much in terms of today's important criteria such as speed, comfort, distance, payload, safety, and reliability. But over time, piecemeal changes gradually improved the performance of this machine. There was a period when the improvements came at a rapid pace, and then they tapered off as the airplane essentially reached its upper limit for performance.

You can see this pattern of development in figure 1.1; it's typically called an "S-curve." Performance of a new system starts out way below its potential

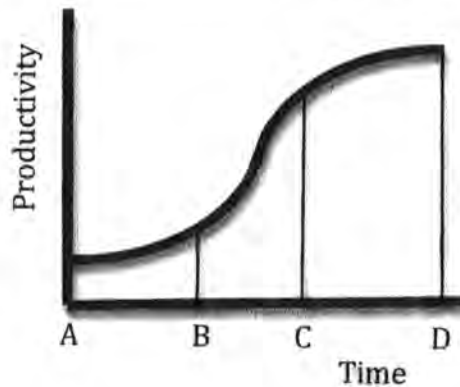


Figure 1.1. An S-curve for System Development Shows Piecemeal Change

(its upper limit), gradually improves at first (from time A to time B in figure 1.1), then undergoes a period of rapid improvement (from time B to time C), and finally tapers off as it approaches its upper limit (time C to time D). Improvements along a single S-curve are called *piecemeal changes* or *reforms*.

When the Industrial Age paradigm of education was first developed to replace the one-room schoolhouse (time A in figure 1.1), it was only able to achieve a relatively low level of student learning compared to what students learned in the 1950s (time C in figure 1.1). Educational reforms were highly effective from the 1930s to the 1950s (from time B to time C). But, over the past four decades, reforms have failed to improve educational outcomes of the overall system. This indicates that the Industrial Age paradigm of education has come so close to its upper limit that even significant investments (of effort and money) on reforms cannot produce the desired improvements in system performance.

To improve performance beyond the upper limit of a system, we must turn to a *different paradigm* that has a higher upper limit. The railroad was the most common paradigm of transportation for most of the Industrial Age, reaching its upper limit in the 1950s.⁴ Achieving improvements beyond that upper limit required the development of a different paradigm, the airplane, as an alternative to the railroad. A new paradigm is represented by a new S-curve, which begins at a relatively low level of productivity (time E in figure 1.2). The airplane's initial performance was lower than the performance of the railroad at time E, but its upper limit (time G), in terms of speed and

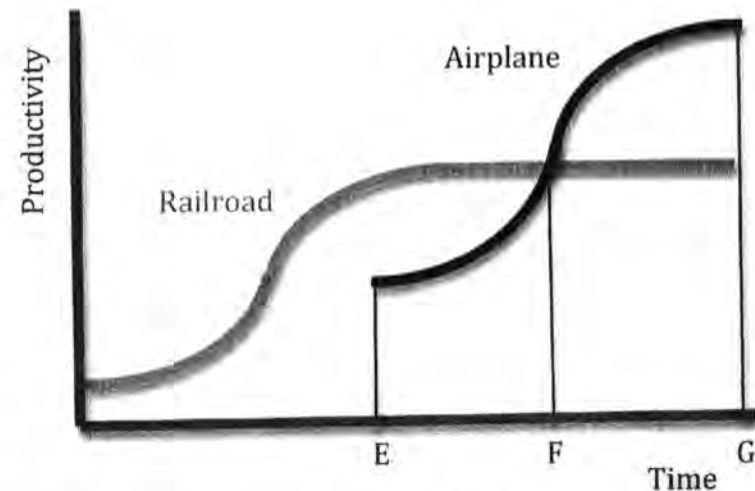


Figure 1.2. S-curves for Two Paradigms of Transportation

distance, safety, and other criteria, is considerably higher than that of the railroad.

In the world of education, “research-based methods of instruction” seem to be getting all the love recently, but the S-curve shows that research could (mis)lead us to abandon a promising new paradigm if, in its early stages of development, it does not match up to an older paradigm. Any research that compared the airplane to the railroad before time F would have led us to abandon it as a “research-based method” of transportation, yet the focus of educational reform today is on research-based methods.

The S-curve story indicates that the Industrial Age paradigm of education has reached its upper limit. Sure, we can improve an *individual* poor-performing school with piecemeal changes, such as replacing less effective educators with more effective ones, but this lowers performance in the schools where those effective teachers come from, so the system overall doesn’t improve. Even if we double the investment per child throughout the current educational system, we would, at best, achieve a small improvement in student learning overall.

But has the Information Age paradigm of education reached the point where it outperforms the factory model of schools (time F in figure 1.2)? The schools described in chapter 3 and the many others listed in appendix A provide some evidence that the answer is “yes,” particularly in terms of measures other than standardized tests, including creativity, initiative, collaboration skills, and responsibility. Therefore, we suggest that any future investments in education are best spent implementing the Information Age paradigm of education and conducting research and development (R&D) to improve it.

CHAPTER SUMMARY OF KEY IDEAS

Efforts to reform the current education system have not been successful. Most schools today are designed more for sorting students than for ensuring learning for all students.

- Time-based student progress forces slower learners to move on before learning the material, wasting time, and creating learning gaps that make future learning more difficult.
- Time-based student progress forces faster learners to wait to move on after learning the material, wasting time, and triggering boredom and frustration.

Education must be designed for student learning, which calls for a different paradigm.

- Student progress must be based on amount of learning (meeting standards), not on the amount of time spent in school or on a specific subject.
- An attainment-based, continuous-progress education system requires new roles for teachers, students, technology, and even parents.

Many schools in today’s education system are designed to leave some children behind.

- The blame belongs to the system, not its people.
- The one-room schoolhouse was the predominant paradigm of education during the Agrarian Age.
- The factory model of schools was the predominant education paradigm during the Industrial Age, when factory labor was predominant, and schools needed to teach students obedience, punctuality, stamina, and standardization, and students were sorted into groups of potential managers or laborers.
- Sorting students is the purpose of norm-referenced student assessment.
- A new paradigm of education is needed and inevitable for the Information Age.

Paradigms have been changing.

- The key characteristics of the Information Age tend to be polar opposites of those of the Industrial Age, and these characteristics represent the deep structure of all societal systems.
- Key characteristics of Information Age systems include customization, diversity, collaboration, team-based organizational structures, shared leadership, empowerment with accountability, initiative or self-direction, self-service, and holism or systems thinking. These help us to envision the new paradigm of education.

The United States has new needs for its education system.

- Knowledge work has replaced factory labor as the predominant form of work, and knowledge work requires higher levels of education for most students than factory labor used to.
- Many aspects of life are now far more complex, and navigating the everyday world requires higher levels of education and thinking for everyone.
- Interrelationships and causal dynamics influence decisions in all aspects of life; understanding this is helpful.

- Diversity of skills is critical for a specialized division of labor, and it requires an educational system that cultivates individual talents of all kinds.
- U.S. citizens must know how to collaborate, communicate well, and resolve conflicts to succeed in modern life.
- People who take initiative to identify and solve problems are more valuable in today's workforce than those who wait to follow orders; people develop initiative through self-directed learning.
- Piecemeal reforms cannot adequately address the new set of student needs; an entirely new education paradigm is required and inevitable.

The S-curve helps for understanding paradigm change.

- Systems evolve to ever-greater complexity.
- The development of any one system is typically characterized by an S-curve, eventually reaching its upper limit and requiring a new paradigm to make further improvements in performance.
- The factory model of schools reached its upper limit a while ago, and further investments in improving it continue to yield disappointing results.
- Investments in education are much better spent to develop the Information Age paradigm rather than pouring money into an outdated model.

NOTES

1. These individuals and statements represent the views expressed by multiple people that we've compiled into these summaries.
2. www.nwlink.com/~donclark/hrd/trainsta.html
3. A quality circle is a volunteer group composed of workers (or even students), usually under the leadership of their supervisor (or an elected team leader), who are trained to identify, analyze, and solve work-related problems and present solutions to management to improve the performance of the organization and to motivate and enrich the work of employees.
4. A new paradigm of a subsystem can raise a system's upper limit, such as the jet engine for the airplane. The high-speed railway has increased the upper limit of the railroad beyond that of the 1950s.

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RELATED WEBSITES

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- The International Association for K–12 Online Learning: www.inacol.org

The National Center on Education and the Economy, New Commission on the Skills of the American Workforce: www.skillscommission.org

The National School Boards Association's Center for Public Education: www.centerforpubliceducation.org

The Partnership for 21st Century Skills: www.21stcenturyskills.org/

The Secretary's Commission on Achieving Necessary Skills: wdr.doleta.gov/SCANS/whatwork/

A Vision of Information Age Education

A learning-focused, attainment-based education paradigm can be implemented inexpensively and well in a school environment. Some places in which this paradigm is already being used are described in chapter 3. But fully implementing a new paradigm requires a massive change in how people look at the role of education overall and the roles of teachers, students, parents, administrators, and even technology. As Phillip Schlechty, a national leader in fundamental change, says, "It requires big changes in the way schools use time, talent, and technology."

The new paradigm of education must meet the educational needs of a school district's community, its state-level educational system, and our society in general (its "systemic environment"). If it doesn't meet those needs, the

TEACHERS: DO YOUR TEACHING PRACTICES ALIGN WITH YOUR CORE BELIEFS ABOUT TEACHING AND LEARNING?

Did you, like most teachers, go into teaching because you wanted to make a positive difference in children's lives? Did you believe you could help every child learn, help each to enjoy learning, and inspire each to learn more?

Are you reaching these goals? If not, what is keeping you from reaching them? Perhaps it is the "system"—the industrial age paradigm. Try to imagine a system that would allow you to reach your goals. What core ideas would it have?