

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?

systemic environment will not support the new school system—with money or students or both. The educational needs of the community include those of its students, parents, employers, government, service organizations, retired citizens, and many more.

Therefore, an accurate vision of the new education paradigm must be based on today's educational needs and the key characteristics for the Information Age (described in chapter 1).

In this chapter, we propose six core ideas that focus on student learning rather than student sorting and provide a solid foundation for schools in the Information Age paradigm. This will place the focus of schools primarily on *learning* to better meet the needs of students and their communities in the modern world. The six core ideas are:

1. attainment-based system
2. learner-centered instruction
3. expanded curriculum that includes twenty-first-century skills
4. new roles for teachers, students, parents, and technology
5. nurturing school culture
6. organizational structures, choice, incentive, and decision-making systems

When these core ideas are implemented, schools in the new paradigm will differ far more from each other than schools do currently. After all, diversity is a key characteristic of the Information Age. Therefore, the core ideas may be implemented in many different ways in the new paradigm.

Furthermore, the new paradigm will better prepare students for the modern world and be more cost-effective than our current paradigm, for reasons we point out at the end of this chapter.

The vision we describe in this chapter is intended to stimulate thinking about what's possible for education, rather than to present a full solution. All aspects presented are not necessary—or even advisable—for every community or school. We present this vision simply to inspire your imagination to see how the U.S. public school system may transcend the factory model that's now in play.

CORE IDEA 1: ATTAINMENT-BASED SYSTEM

For an education system to be focused primarily on learning, student progress must be based on learning, not time. This means that student assessment and records must indicate what a student has actually learned, rather than comparing her to other students.

Student Progress

When this core idea is operating, each student moves on to a new topic or competency only after demonstrating proficiency through a fixed and credible standard of achievement—not when a fixed amount of time has passed or when other students hit certain achievement milestones. A student is not forced to move on before reaching the proficiency standard, and each student moves on as soon as the standard is reached. This is a standards-based approach to education in a true sense of the term, and this core idea is vital to maximum student learning.

Testing

The twin purposes of student evaluation are to guide student learning (known as *formative assessment*) and to validate student achievement (which is *summative assessment*). *Norm-referenced assessment* is what we have in today's education system, and it serves to compare students with each other. Norm-referenced assessment is not used in the Information Age paradigm.

Formative assessment (also covered in the upcoming “Learner-Centered Instruction” section) provides each student with immediate feedback on performance, with hints and other forms of guidance to help the student learn from her successes and failures. Summative assessment validates a student's competency at a certain level or standard. These performance-based assessments are fully integrated with instruction, so no time is taken away from learning for testing.

In the Information Age paradigm we envision, all students are expected to finish learning whatever they undertake to learn. In other words, all learning continues until it is successful. Each summative assessment is based on a single competency (or a small set of them), rather than on a comprehensive basis or a large number of learning areas at once. This means there would never be a single large assessment to cover an entire school term. Further, these small assessments are integrated naturally and seamlessly with personalized instruction to certify as well as improve learning. This means that students take tests when they are ready for them, based on their individual learning needs and progress—not at a predetermined time established by the curriculum, administrators, politicians, or bureaucrats.

Student learning in the academic disciplines is assessed, and students are also expected to demonstrate an understanding of how to apply cross-discipline knowledge in a series of real-world projects. This approach ensures that students have a solid grasp on the essentials while also pushing them to apply their learning to various contexts, which provides educators a more accurate picture of an individual's educational progress.

Report Cards

Results of summative assessments are entered into a record of attainments for each student. In a technology-based learning environment, this happens automatically when possible. When human judgment is needed, an expert observer can evaluate the student using a mobile device that contains an appropriate observation rubric.

Student records are automatically maintained and updated for teachers, and each attainment may be linked to a portfolio item that provides supporting documentation when appropriate. The Information Age report card contains no grades; instead, it contains lists or maps of attainments for which a student has met the standards of competency, as in the Khan Academy, which is a website that offers free use of a library with more than 3,800 videos on everything from arithmetic to history and hundreds of skills to practice with immediate feedback and built-in competency assessment and records of attainments.

Parents who want to compare their child with other children can compare levels of attainment instead of grades, but it's likely that any one student will be ahead of another in some areas and behind that same other student in other areas, reducing stigma for any given child. All children eventually succeed at all learning they undertake in the Information Age paradigm, which greatly enhances individual motivation and self-esteem.

CORE IDEA 2: LEARNER-CENTERED INSTRUCTION

An attainment-based system requires instruction to be customized to each student's learning needs rather than standardized. This creates benefits for using project-based learning, collaborative learning, instructional support, and the treatment of children with special needs.

Customized (or Personalized) Learning

Attainment-based student progress is one form of customization (*customized pacing*). But the Information Age paradigm goes beyond this to include *customized content* and *customized methods* as well.

Regarding content, all students in the Information Age paradigm are required to learn a core body of material, which usually entails focusing on deficits regarding the requirements (and thus is often called *deficit-based learning*). However, considerable time is also available for students to cultivate their individual talents, interests, and strengths (often called *asset-based learning*). In the Information Age system we envision, the best of both defi-

cit- and asset-based approaches are applied, representing “both-and” rather than “either-or” thinking.

Regarding methods, Howard Gardner, who is famous for his work on multiple intelligences, has shown that students differ in their profile of eight major kinds of intelligence and has argued that a student's strongest intelligences can be used most effectively as “entry points” for learning new knowledge, skills, and attitudes. Consequently, methods are customized in two major ways: through student selection of projects and through customized tutorials (both are described later in this section). Project selection and tutorials are customized according to multiple intelligences, student interests, learning styles, and other kinds of learner characteristics and preferences.

Personal learning plans or *learning contracts* (different in important ways from individualized education plans [IEPs]¹) are essential planning and monitoring tools for customizing learning. The parents, mentor-teacher, and student meet on a regular basis (perhaps every two or three months) to establish a new plan or contract for the next period and to review the student's accomplishments on the previous plan. The parents and student have considerable input to specify the goals and outcomes in the plan, but the teacher, community, state, and even the nation have the right and obligation to assure (through monitoring) that appropriate standards are being met. However, there is considerable flexibility in deciding when which standards are met.

Means for how student goals will be met are also identified in the planning meeting, with parents and teacher assuming agreed-on roles in support of the student's efforts. This approach to creating and managing a personal learning plan can be implemented cost-effectively with the help of technology, as described in “Core Idea 3: New Roles” later in this chapter.

Project-Based Learning

To truly customize learning, students must be allowed to work on different tasks that are relevant to their individual interests and needs. Authentic projects (that is, projects that are real-world or similar to real-world) are powerful for customized learning because they enhance *intrinsic motivation*,² which is crucial to accelerating learning. Such projects also aid the transfer of learning to practical situations.

Well-designed tasks that are not authentic projects can also be powerful ways to customize learning, particularly for younger learners, as demonstrated in Montessori preschools (see chapter 4), where students are deeply engaged in performing a task over and over and over again—by choice. Mastery is a powerful motivator.

Most projects are interdisciplinary to be authentic and require a relatively long time to complete—days for younger students and weeks or months for older ones. Formative assessment, including guidance and coaching, is provided in projects, either by a teacher or by a technology system in a simulation or “virtual world,” like *Second Life*. Summative assessment is conducted but doesn’t offer much value for assessing individual learning in project work unless a student does the project alone.

Some projects are community-based service projects, others are conducted through computer-based simulations or virtual worlds, and still others use a combination of the two through use of mobile devices (another example of both—and thinking).

Collaborative Learning

In businesses, a great deal of knowledge work is done in teams. Collaboration is important in work life, civic life, and family life, and working with others provides extra motivation to students who enjoy a social dimension to learning. Collaboration also provides a valuable opportunity for students to learn from each other. Team-based learning pushes students to develop their teamwork and conflict-resolution skills with teacher guidance. However, students may occasionally choose to work independently on a project.

Instructional Support

As powerful as collaborative project-based learning is for motivation and real-world application of knowledge, we have found four shortcomings of team-based project work in our teaching experience:

1. A team typically produces a product, and the whole team is assessed on that product. This makes it difficult to ensure that all students learned the important project-related competencies. Sometimes a team has a loafer who doesn’t learn much at all. Also, teammates often work cooperatively rather than collaboratively, meaning each person performs different tasks and therefore learns different things. In our experience, it is rare for any student to learn all the intended lessons of a project. For a system in which student progress is based on learning, it is important to accurately determine what each student on the team learns, but this is tough to do in project-based learning.
2. The skills and competencies available through projects are usually ones that learners need to transfer to a broad range of situations, especially for complex cognitive tasks. However, in project-based learning, stu-

dents typically use a skill only once or twice during the project. This makes it difficult for them to learn to use the skill in the full range of situations in which they are likely to need it in the future. Many skills require extensive practice to develop to a proficient or expert level, yet that rarely happens in project-based learning.

3. Some skills need to become automatic, or performed without thinking, to free up the student’s conscious cognitive processing for higher-level thinking when executing a task. For example, when a person first learns to drive a car, he’s usually so focused on the mechanics of driving that he cannot pay attention to more strategic issues of navigation and defensive driving tactics. After a while, the mechanics of driving become automatic (they’re performed easily and quickly without thinking), so drivers can pay more attention to higher-level, strategic thinking. Project-based learning does not address this need to automate some lower-level skills.
4. Much learner time can be wasted during project-based learning by searching for information and struggling to learn without sufficient guidance or support.

Fortunately, the benefits of project-based learning can still be captured by providing appropriate instructional support during a project to address all four problems.

For example, technology already exists for creating a system whereby students in a team can work on an authentic project in a computer-based simulation, or virtual world, until they encounter a need to learn something new. At that point, project time might freeze and a virtual teacher would appear for each student, perhaps on her own personal work tablet, to provide individualized tutoring. The student could then work on developing the needed skill or acquiring the knowledge or attitude just in time for use in the project. This kind of tool is known as an *instructional overlay* for project-based learning. It can also be provided by a teacher instead of a computer-based tutorial or simulation, but using digital technologies for this assistance can greatly lower the cost of the assistance.

Research shows that people best learn a skill when they’re told how to do it, shown how to do it, and can practice it with immediate feedback. Instructional overlay helps students learn to generalize or transfer a new skill to a range of cases he may encounter in the real world. The student continues to practice until he reaches the standard for competency—perhaps ten correct performances in a row, the metric used by the Khan Academy. Then he returns to the project to use it right away and continues working on the project until the next learning need is encountered, and this learning cycle repeats.

The instructional overlay has many benefits.

- It reduces frustration and learning time.
- It ensures that students can generalize learning to diverse situations.
- It allows for automating lower-level skills that need it.
- The mastery requirement ensures individual accountability in a team-based, holistic learning environment thus combining the best of constructivist learning and direct instruction approaches (another example of the “both-and” thinking that characterizes the Information Age).

Special Needs

The Information Age paradigm accommodates children with special needs in the very fabric of its design. In this paradigm, all children are special. Education is personalized for all children. All students are closely monitored for progress and receive the emotional and intellectual attention they require and deserve. Children with cognitive disabilities and other health- and medical-based problems are integrated fully into the education system and work on projects with all other types of children. Specialized staff are available when needed, as explained in “Core Idea 5: A Nurturing School Culture.”

CORE IDEA 3: EXPANDED CURRICULUM

The goal of the Information Age paradigm is to develop people who

- are capable of creating a high quality of life for themselves, their families, and their communities;
- have the historical and civic knowledge to be good citizens of both their country and the global society; and
- can apply competencies that help them to succeed in their chosen careers.

These attributes apply to preparation for the workplace as well as to family life, civic responsibilities, and personal fulfillment. A fully functional education system must address all aspects of child development and provide students with the self-directed learning skills and motivation they need to continue their learning throughout their lives.

Pipe dream or possible? Before you answer, consider all the nonacademic things schools are already being asked to do. Yet educators can’t even get all their students to perform at grade level in the basic subjects. Can we ask teachers to address all these other kinds of learning, too? Actually, not in the

Industrial Age paradigm, because its structure makes it almost impossible to meet student needs. But Information Age schools are already doing remarkably well with these additional kinds of learning and with learning in the academic subjects (see chapter 3).

At this point, you may be wondering what the important kinds of learning are.

National Reports

Recognizing that dramatic changes in the workplace have important implications for curriculum, the U.S. Department of Labor commissioned the Secretary’s Commission on Achieving Necessary Skills (SCANS) Report for America 2000, which was released in 1991. In brief, that report recommended that primary and secondary school curriculum should include the following elements:

- basic skills, including the ability to read, write, perform mathematical operations, and listen and speak effectively
- thinking skills, including ability to think creatively, make decisions, solve problems, and visualize outcomes
- personal qualities, including responsibility, self-esteem, good interpersonal skills, self-management, and integrity
- competency in use of resources, information, technology, interpersonal skills, and systems thinking

Building on this foundation, in 2009 the Partnership for 21st Century Skills published its *Framework for 21st Century Learning*, which provided these updates to curriculum guidelines:

- Core subjects include English, reading or language arts, world languages, arts, mathematics, economics, science, geography, history, government and civics.
- 21st Century interdisciplinary themes, woven into core subjects, include global awareness; financial, economic, business, and entrepreneurial literacy; civic and health literacy.
- Learning and innovation skills include creativity, critical thinking, and problem solving, as well as communication and collaboration.
- Information, media, and technology skills include information literacy, media literacy, and communications literacy.
- Life and career skills cover flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility.

Other Kinds of Learning

A core of *character traits* and *democratic values* is important for the health of our democracy and our communities. Also, Daniel Goleman popularized the understanding that success in life depends more on one's *emotional development* (emotional quotient, or EQ) than intellectual development (intelligence quotient, or IQ).

Emotional development can save a lot of money for society (e.g., less crime and prison time) and improve the quality of life for individuals, communities, and nations. It has proven to reduce substance abuse, teen pregnancy, bullying, and other social problems. Poor emotional development also typically results in a "fight or flight" response that hurts learning, increases the odds of delinquency and imprisonment, and perpetuates a cycle of poverty.

On a larger scale, insufficient development of emotional intelligence and the core values of our democracy have arguably led to national and international problems, including the Enron scandal, the Madoff ponzi scheme, the global financial crisis of 2008, and many other incidents of corruption, violence, and crime. In fact, prison populations are predicted based on third-grade reading scores. It is far less expensive to educate children well than to incarcerate them.

The social and monetary costs of insufficient attention to emotional development and to nurturing core values in people are extremely high. In the Information Age paradigm of education, emotional and values development are addressed by the teacher throughout the day as teachable moments arise during students' interactions with each other, making the learning experience customized and authentic. These teachable moments are anticipated and valued as a part of the learning experience, rather than as distractions taking time away from what students should be learning. Such development occurs much more effectively in a classroom with teacher guidance than on the playground without it.

Finally, the importance of healthy *physical development* through exercise and nutrition is also increasingly evident.

The Information Age paradigm incorporates all the previously described curricular areas in its mission to foster all aspects of human development, including what Bela Banathy, a pioneer in systems thinking about education, refers to as the sociocultural, ethical, moral, physical/mental/spiritual wellness, economic, political, scientific/technological, and aesthetic dimensions of learning. Yet specific points of curriculum will need to adapt to advances in knowledge and changes in student needs and society's values.

The Information Age curriculum must provide students with a solid understanding of important concepts and principles and an ability to apply their understanding to real-life problems and situations. Many of the target areas

of competency are the same for every student, but many others are different depending on an individual student's needs, talents, interests, and aspirations. Personal learning plans and customized teaching methods ensure that individual learning needs and styles are addressed.

CORE IDEA 4: NEW ROLES

Learner-centered instruction requires teachers, students, parents, and even technology and other learning resources to function dramatically differently from their roles in the Industrial Age system.

Teachers

In the Information Age paradigm, the teacher is not a judge who serves as a perceived threat to a student but is instead a guide or coach who helps students conquer obstacles. This is a move from teacher-centered to learner-centered education—from a teacher functioning as a sage on the stage to a guide on the side.

The teacher assumes these five roles in the Information Age education system:

1. *Mentor* for perhaps twenty to thirty students for several years, one who is concerned with all aspects of student development, as practiced in the Montessori system and the Minnesota New Country School (see chapter 3). It has been said, "Kids need to think that you care before they care what you think." Part of the mentor role is helping students prepare a personal learning plan for each project period, which runs for six to twelve weeks. This involves helping the student and parents choose appropriate instructional goals (subject to standards set by the community, state, and nation) and then helping to identify and support the best means for the student to achieve those goals.
2. *Designer* of student work options, mostly projects or tasks, to engage students in the learning process. Open educational resources that are developed by teachers throughout the country and available to all educators for free via the Internet can alleviate much of the burden of the designer role.
3. *Facilitator* of the learning process, which entails monitoring student progress, enhancing student motivation, and coaching student performance.
4. *Learner*, the teacher is always learning with the students, about the students, from and for the students. The teacher does not have all the

answers, but the teacher helps students find answers. And the teacher is always learning more about how best to meet students' needs. The Information Age paradigm provides sufficient support for teacher learning.

5. *Owner and manager* of the school. Like lawyers and accountants in a small firm, teachers are partners who own their public school and make decisions about its operations, including budgeting and staffing (see "Core Idea 6: Organizational Structures"), as the Minnesota New Country School is structured. This elevates the role of teachers to that of true professionals, rather than workers controlled by an all-powerful bureaucracy.

Some teachers specialize in one or two of these roles at which they excel. These roles for teachers are so different from their roles in the factory model of schools that some people argue that the term *teacher* miscommunicates the nature of this position in the Information Age system. Since the role is often characterized as that of a guide on the side, we use the term *guide* instead of *teacher* whenever talking about teachers in the Information Age paradigm.

Students

Students in the Information Age paradigm assume three new roles in place of the traditional role as isolated, passive learner.

1. *Self-directed learner*. Lifelong learning is critical for success in the Information Age, as discussed in chapter 1, and it requires self-directed learning, so students must be taught at an early age to manage their own learning process, as Montessori schools emphasize beginning at age three. Students need to learn to set goals and plan the means to achieve their goals. This includes figuring out how they learn best, what learning strategies and tools best serve their learning styles, and how to improve their learning styles. Learning to be self-directed requires some degree of student choice of both content and instructional methods, and guides help to cultivate students' ability to make good choices.
2. *Learner as teacher*. There is an adage that says the best way to learn something is to teach it. With that in mind, students may be the most underutilized resource in schools today. In the Information Age paradigm, students on a project team teach each other. And students who have already attained a competency standard tutor or coach other students who are still working to learn that material. Therefore, *student as teacher*

is another new role for students. This student role is already becoming more common in many schools.

3. *Collaborative learner*. In the "Collaborative Learning" section earlier in this chapter, we described a new role of students as collaborative learners, in contrast to the Industrial Age perspective that students are cheating if they collaborate. New methods are used in the new paradigm to ensure that students learn and don't cheat. Learning how to learn from and with peers will serve students well in all aspects of their lives, including their jobs and marriages.

Parents

Parents in the Information Age paradigm are more actively involved in deciding what their child will learn and helping her to learn it. Parents have access to specific guidance for fun things they can do with their child to help her learn—from questions to ask at different exhibits in the local zoo and information on what makes a good answer, to places to see and things to do on a vacation. Parents also have some input into how their child's school is run. Parents are true partners with their child's guide in the new paradigm.

Technology and Other Resources

Appropriate learning tools are vital to implementing the Information Age paradigm of education in a feasible and cost-effective way (see "Cost-Effectiveness" toward the end of this chapter).

To get a handle on the relationship between the tools of an age and the age itself, consider the role of the railroad in the Industrial Age. Manufacturing made the railroad necessary—to ship large quantities of raw materials and finished goods to and from factories. But it also made the railroad possible—because the railroad could only be created with industrial processes and tools.

Similarly, the Information Age makes the new paradigm of education not only necessary, but also possible, for it is greatly facilitated with digital technology. In fact, such technology has revolutionized all kinds of industries—from the electronic spreadsheet in accounting to imaging technologies in healthcare.

In the Information Age paradigm, digital technology and hands-on materials play a central role, as opposed to the small peripheral role they play in the current, teacher-centered paradigm. Digital technology is primarily for student use, rather than primarily for teacher use, in the new system.

Here, we describe the four main roles of technology in the Information Age. Note that we use the present tense to describe these roles, but we are not aware of any technology system that currently serves all these roles.

Recordkeeping for Student Learning

Keeping track of what every student has learned could be a nightmare for guides, especially when students are doing a lot of their learning in learning centers (away from the guide—see “Core Idea 6: Organizational Structures”). Technology is ideally suited to save guides huge amounts of time on monitoring records of student competency. The recordkeeping function of technology replaces the current report card and has three parts.

The *Record of Standards* includes both required educational standards (national, state, and local) and optional educational standards, broken down into individual competencies and arranged in learning pathways (when learning segments build on each other). Standards are easily accessed by guides, students, and parents. This technological tool presents a list or map of learning areas that the student should or can master, along with levels and criteria at which they can be learned.

The *Record of Personal Attainments* documents what each student knows. In essence, this record maps each student’s progress on the standards listed in the Standards Inventory. It shows when a student met a standard, which standards were required, and what the next required standard is in each area. This record also provides links to evidence of competency (in the form of summary data and/or original products).

The *Record of Personal Characteristics* keeps track of each student’s characteristics that influence learning, such as learning style, profile of multiple intelligences, student interests, and major life events.

Planning for Student Learning

Developing a personal learning plan, or contract, for all of their students could be difficult for guides. Fortunately, technology is ideally suited to fulfill this role in the Information Age paradigm. This role for technology helps each student, parent, and guide perform these tasks:

1. *Set long-term goals.*
2. *Consider options.* Identify the full range of attainments that are presently within reach for the student (based on the Record of Personal Attainments).
3. *Set short-term goals.* Select which options to pursue in the short term, based on requirements, long-term goals, interests, and opportunities.

4. *Select projects.* Choose from a menu of projects or design new projects as means for attaining the short-term goals.
5. *Assemble teams.* Identify other students who are interested in doing the same projects and select appropriate teammates.
6. *Assign roles.* Determine how the guide, parent, and other individuals might support the student in learning.
7. *Develop contracts.* A learning plan specifies goals, projects, teams, roles, and a timeline for each project.

Students in the Information Age education paradigm must learn to manage their time and meet deadlines, just like people do in the working world. But time available for various projects in the new system is flexible based on the number of projects each student takes on, and a student’s workload during a given period is tailored to his abilities.

Instruction for Student Learning

Trying to teach twenty-five students who are all learning different things at any point in time would be very difficult if guides could only use Industrial Age, teacher-centered instruction. But that’s not the case in the Information Age paradigm. Technology can introduce projects, provide instructional support during projects, help manage projects, and even help develop new projects and instructional support—all in a learning environment that fosters development of relationships among students and with guides.

Introduce Projects Technology (computers and mobile devices) can introduce a project to a student (or small team), often with simulations, virtual worlds, and engaging, interactive video. It can also provide project-management programs to help students succeed and project-tracking programs to help guides support student success.

Provide Instructional Support Technology can provide powerful instructional tools—simulations, tutorials, drill and practice, research tools, and communication tools—to support learning during a project and allow each student to spend as much time as needed in learning-by-doing (practicing) to attain each learning standard (much like the education program at the Khan Academy). This is basically an *instructional overlay* (described in “Core Idea 2: Learner-Centered Instruction”) on project-based learning, and different kinds of instructional support are provided for development of specific attainments (such as higher-order thinking skills, deep understandings, memorization, emotional development) and different kinds of learners (based on their learning styles). While project work makes learning more fun, the instructional overlay makes the learning experience more effective and efficient and often reduces frustration.

Digital tools offer many benefits, including these:

- They're more dynamic in sight and sound than static resources and thus accommodate a greater variety of learning modalities.
- They offer powerful interaction for active student learning and immediate feedback.
- Internet access connects students and guides across geographic and cultural boundaries for a greatly enriched learning environment and eliminates the need to physically be in the same place at the same time.
- Staff development is available on demand—even in rural areas where teachers currently receive little support.
- These tools help guides monitor and support student progress on projects, and they help students monitor and reflect on their own progress and manage their time.

Yet high-tech resources are not the only technologies used in the Information Age paradigm; low-tech, hands-on resources, like number rods and sandpaper letters (see chapter 3), are also useful, especially for younger students. Learning resources are frequently designed for several students to use together, to promote learning with and from each other and to build strong relationships among students. Guides help students, through coaching and tutoring, as they use the resources, and they provide direct instructional support as necessary, complementing the high-tech and hands-on resources.

Help Manage Projects Technology provides tools for monitoring and supporting student progress on a project, not just for guides, but also for students to monitor and reflect on their progress and manage their time.

Help Develop Instruction Technology even provides tools to help guides and others develop new projects and new tools for the instructional overlay.

Guides and their assistants and volunteers assist students in their use of technology in their projects and instructional overlay, and they provide instructional support when technology cannot.

Assessment for and of Student Learning

Conducting formative and summative assessments of students could be a nightmare for guides in a world where students are demonstrating competency in different ways and at different times. Technology helps with these tasks.

In the instructional overlay—whether in a simulation or tutorial or drill and practice—the technology system is designed to provide formative feedback to the student and to evaluate whether the student meets the criteria for mastery of all the different kinds of learning.

When the criteria for successful performance have been met on, say, the last ten unaided performances, the summative assessment is complete and the corresponding attainment is automatically checked off in the student's Record of Personal Attainments. There is no separate assessment; the practice is the test, which saves a lot of time that would otherwise be wasted on testing. This is full integration of testing with instruction.

When interactive technology cannot assess a student's performance, an expert observer (perhaps using a handheld device with a rubric for assessment) evaluates performance and provides feedback. The information from the handheld device is automatically uploaded into the computer system, where it's placed in the student's Record of Personal Attainments.

Beyond student assessment, the computer system automatically analyzes the quality of the instructional tools, the guides, and the "schools" (which, by the way, are not called schools in the new paradigm because they are so different from what we know as schools today), and the information is used for both formative and summative purposes. Find more on how schools operate in the new paradigm in Core Ideas 5 and 6.

Finally, technology provides tools to help guides develop assessments and link them to the appropriate standards in the Record of Standards. These computer-generated assessment tools significantly reduce the amount of student and guide time currently devoted to carrying out assessment activities in the Industrial Age paradigm.

Integration of Tools

We envision that these four roles or functions of technology are seamlessly integrated, though such a system has yet to be developed as far as we know. We envision a system in which the recordkeeping tool informs the student-planning tool, which identifies instructional tools that are available to carry out the plans. Assessment processes are integrated into instructional tools and feed data to the recordkeeping tool. The student, parent, and guide all have easy access to progress reports on each of the student's projects and on the set of standards and individual attainments currently being pursued in the student's contract.

There is no label that describes this kind of comprehensive, integrated tool; recently, the term Personalized Integrated Educational System (PIES) was suggested. We like it!

In addition to the primary functions described earlier, we expect PIES to serve these and other secondary functions:

- communications, including e-mail, blogs, websites, discussion boards, wikis, whiteboards, instant messaging, podcasts, and videocasts

- administrative access to information and authority to input information based on role and information type
- documenting general student data, such as address, parent/guardian information, guide and cluster identification, student attendance, and medical information
- central resource on educator data, including office address, certifications and awards, professional development plan and records as well as a list of students (and their evaluations and earned awards) and repository of teaching tools they developed
- PIES will hopefully be open source software, similar to Moodle, making it affordable.

Ideally, it will be possible for districts, schools, and individuals to customize and modify the program for their own needs and to incorporate web apps (similar to iPhone apps) from various developers to support specific needs. Users can customize the look and function of their sites, controlling the flow of information into the site with RSS feeds and e-mail, and easily incorporating such features as blogs, discussion boards, and chats within PIES.

Indeed, technology plays a vital role in the success of the Information Age education paradigm. It enables a quantum improvement in student learning and likely at a lower cost per student per year than the Industrial Age paradigm (discussed in an upcoming section, “Cost-Effectiveness”).

CORE IDEA 5: A NURTURING SCHOOL CULTURE

The Information Age education paradigm is characterized by a caring and supportive educational environment that features small school sizes, strong relationships, multiyear mentoring, multiage grouping into developmental levels, enjoyable learning, guides’ learning, and family services. School culture has a profound effect on both students and guides.

Small School Size

Large schools tend to breed student alienation and the formation of adversarial cliques and bullying. They also require more administrative overhead than small schools, which provide a learning environment more conducive to caring and the development of emotional intelligence. However, among the advantages of large schools are:

- reduced costs for shared facilities, such as library, media center, cafeteria, gymnasium, and auditorium
- ability to offer a greater variety of courses

In the Information Age paradigm, the cost savings that large schools enjoy for shared facilities is resolved by placing shared facilities in a central area surrounded by small learning communities. Also, the greater variety of courses is neutralized by information technologies, open educational resources, and interactive multimedia programs over the Internet.

Strong Relationships

In addition to small cluster (school) size, each learning community in the new paradigm strives to form deep ties that connect students, guides, parents, and the larger community, often through collaborative projects and other relationship-building activities.

Multiyear Mentoring

Guide and students stay paired for a complete stage of child development (about three or four years), and each student has some choice of mentor for that time (see “Choice” in Core Idea 6). Getting to know each other well facilitates the growth of caring, trust, and support between a guide and student and provides a broader, more stable support network for the student.

Multiage Grouping into Developmental Levels

In all settings apart from schools, people associate with others of different ages. Younger people adopt older ones as role models, and older people assume some responsibility for younger people. In many situations, age isn’t even a factor in social association. Instead, interests drive association. Similarly in the Information Age paradigm, a guide has roughly equal numbers of students across the age span for a developmental level.

The *first level* of development in the new paradigm begins at birth; all students get a head start! The learning at this level occurs either at home through parents and siblings (under guidance from a guide and/or a family services specialist as needed and desired by the parents), or with parents and a home-room as a daycare option (with young assistants under the direction of a guide and/or family services specialist).

Family services include autism specialists and speech therapists. The guide and family services specialists provide advice and resources to parents as desired, to help them raise their children as well as they can. (More information is to follow about the family service organizations that are integrated into the new paradigm of education.)

The *second level* of development goes from about age three to six, when the children are concrete thinkers, as the Montessori system does (see chapter 3), and guides in the Information Age paradigm are similar to Montessori

educators in many ways. That is, most of the learning occurs in a homeroom, where the guide and/or assistants introduce children to well-designed, hands-on resources as the children become ready for them to pursue specific types of learning. Caring educators have high expectations and nurture the full, well-rounded development of students in partnership with parents, to the extent desired by the parents. Guides also work to get parents more involved in their child's educational development, if necessary. The learning environment is designed to address children's drive toward order at this stage of their development.

The *third level* is very similar to the second except that the students—ages six to nine—assume more responsibility for planning and tracking their own learning. At this level, guides also help students transition from concrete to abstract thinking and work to hone their imaginations.

At the *fourth level*, ages nine to twelve, guides recognize that students have become abstract thinkers, and guides make connections between learning and the outside world through the nature of their projects and other means. Most of the students' work is done in the homeroom, but they begin going to learning centers (described next in Core Idea 6) and community sites (with supervision) for some of their learning.

The *fifth level* typically spans ages twelve to fifteen and is similar to Level 4 except that students do progressively more of their work at learning centers and community sites, so the homeroom has fewer resources and more meeting spaces and workspaces with digital technologies. Some schools use the mini economy—an experience-based instructional program designed to help students learn about economics, entrepreneurship, and government in a motivational way. It assists students in understanding the real world and can provide service to their communities.

At the *sixth level*, ages fifteen to eighteen, the facility is even more of a conference room with workspaces and little resemblance to the homeroom and activity room characteristic of lower levels. Most content learning occurs in learning centers (described in Core Idea 6), including center-sponsored seminars, projects, and tutoring sessions. Students tend to work in small groups. Project-based learning, including intellectual scavenger hunts entailing interdisciplinary problem solving, is widely used.

The guide also works with parents to develop the student's attitudes, values, and ethics; honesty, work ethic, responsibility, initiative, and perseverance are valued attributes for students in this paradigm. Students are required to complete community service projects, and the guide works closely with parents to address the child's emotional, social, creative, and psychological development. This entails identifying any aspects of development that warrant attention and obstacles to further development as well as developing an appropriate self-discipline plan with parents.

As child development levels, these categories do not entail rigid levels of skill or content learning. A child might be at a certain level based largely on her social and emotional development, but work on projects that are typically done by students in the next higher (or lower) level. In other words, "social promotion" is decoupled from "cognitive learning promotion." A nine-year-old could be studying college material without having to leave his peer group. Similarly, the child development levels do not represent rigid age levels because some children develop faster than others.

Enjoyable Learning

In the age of knowledge work and complexity, lifelong learning is essential to citizens' quality of life and the health of communities. Lifelong learning is greatly enhanced by love of learning. In the Industrial Age paradigm of education, many students hate learning, and the culture of schools devalues and derides students who excel in learning. That mindset and culture sabotage lifelong learning.

Although lifelong learning has, for many years, been a buzzword in education, the Industrial Age paradigm inherently impedes it. The Information Age paradigm, however, cultivates a love of learning in students by fostering intrinsic motivation, which requires learning through authentic, engaging projects or tasks. It also cultivates the skills for self-directed learning.

McClellan identifies three major human motives (intrinsic motivators), and the Information Age paradigm uses these motivators to inspire students to learn:

- The *need for achievement* is addressed by attainment-based student progress; a student checks off attainments as she meets standards.
- The *need for affiliation* is addressed by collaborative, team-based learning.
- The *need for power* is addressed by self-directed learning.

Guide Learning

One of the roles of guides in the Information Age paradigm is guide-as-learner (described in Core Idea 3). To be a good role model, the guide models lifelong learning. In the new paradigm, knowledge about content is far less important than knowledge about students and how they learn best. This learning is a journey that never ends, and it helps keep the teaching profession fresh and exciting for guides. The new paradigm places high priority on fostering all kinds of learning for guides, in part by having guides team with

one or more other guides on the same developmental level. This allows them to learn from each other on a frequent basis.

Family Services

The school collaborates with social service agencies to provide various services to families, including development of parenting skills, advice about parenting, childcare support (on a cooperative basis, described in Core Idea 6), help with health and welfare issues, support for children's sports leagues, and so forth. The school system is an integrated part of a community development and services system.

CORE IDEA 6: ORGANIZATIONAL STRUCTURE AND INCENTIVES

The Industrial Age paradigm of education is dominated by top-down, bureaucratic decision-making structures, a focus on compliance (i.e., disempowerment of teachers and students), rigidity, seniority, political influence, and little-to-no choice for students or guides. In this section we describe an organizational structure that redefines schools. In the new paradigm we envision, organizational structures and decision-making systems include small guide-owned schools called *clusters*, learning centers, choice for students and guides, collaboration with family service support systems, and schools as "learning cooperatives."

Clusters as Schools

In the medical and legal professions, colleagues often consult with each other rather than working in isolation. Unlike teachers today, professionals in other walks of life participate in a meaningful way in decision making and have some control over the organizations in which they work. In a similar way, a guide in the Information Age paradigm does not work independently, but is a member of a cluster of guides who own and run their own cluster. This is a professional model of teaching rather than a supervisory (labor-management) model. This concept is so different from schools as we think of them today that the term *school* is a misleading term in the context of the new paradigm; we use the term *cluster*.

A cluster—containing four to ten guides, teaching assistants, and their students—functions somewhat like an independent contractor hired by the school district. In the larger Industrial Age school buildings, each cluster

rents a separate wing or floor of the building and shares some facilities, such as the gym, library, and cafeteria. Anywhere from one to forty clusters are located in a single building, depending on its size.

New educational buildings have a very different design that places shared facilities in a central area, like the hub of a wheel, surrounded by a cluster on each spoke of the wheel.

In this setup, each guide has considerable responsibility for the success of the cluster and a high level of incentive and authority for meeting that responsibility.

Learning Centers

The guide and students have access to various learning centers as well as specialists and experts in other settings. A learning center provides instruction in a *focus area*, which might be any of the following:

- a traditional discipline-oriented area such as biology
- a cross-disciplinary thematic area such as pollution or cities
- an intellectual area such as philosophy
- a technical area such as automobile maintenance and repair

In all cases, centers integrate instruction on basic skills and higher-order thinking skills into the focus-area instruction, and the cluster guide helps each student put together a personal learning plan that represents a good progression for acquiring skills and meeting required standards.

At lower developmental levels, learning centers are seldom used, but a guide's homeroom contains mini learning centers, as in Montessori schools and the Minnesota New Country School (see chapter 3). At higher developmental levels, learning centers operate independently of clusters. Every few months students receive a certain number of passes that entitle them to use the learning centers; and students can earn additional passes.

The number of passes varies with developmental level, and clusters that issue fewer passes have more resource money to put into their own learning centers. Therefore, as a general rule, the older the child, the more she uses the centers.

Budgets for learning centers are based on the number of students served (the number of passes tallied), giving learning centers considerable incentive to attract students and satisfy cluster guides' needs. This means that a combination of competition among learning centers and cooperation within a center exists to maximize performance, again representing both—and thinking.

We envision three types of learning centers:

- *Shopping mall centers* are centrally located facilities ranging from a one-person “craft shop” operation to a regional or national chain. They offer powerful learning environments that incorporate a range of resources—from hands-on materials to web-based multimedia learning environments.
- *Community centers* are located in community settings, such as museums, zoos, and businesses. These centers bring in extra income and tax breaks for their sponsors to support the learning center activities, and they offer students important learning resources in real-world settings.
- *Mobile centers* travel from one cluster to another and even from one community to another. They are found mostly in low population areas and for particularly expensive learning resources, such as an electron microscope or a mass spectrometer.

As in retail businesses, competition pressures learning centers to adjust their offerings to meet the changing needs of students and their clusters. Learning centers spring up and die off on a regular basis. Incubation policies and resources encourage the formation of new learning centers to support a continuous renewal process. Cooperative arrangements are made so children may use learning centers located in other school districts such as the Challenger Learning Center in the Metropolitan School District of Decatur Township in Indianapolis. Learning centers are staffed by certified guides and technical and creative experts as well as parents and community members as volunteers.

Choice for Students and Parents

Students, or their parents, request, in order of preference, their choice of three to five guides. An independent Consumer Aid Agency (described under “Administrative Structures” next) provides information and assistance to parents to help them make the best decision or make it for them if they don’t care.

Each guide decides how many children to accept each year but does not decide which children to accept; this policy ensures that students get equal access to a quality education. “Which children” is decided by a formula that maximizes the number of first choices filled district-wide, within the constraints of racial and socioeconomic balance guidelines. And each guide’s pay varies in part according to the number of students she accepts. Also affecting pay is the cluster’s success in teaching, which is measured by gains in all areas of learning and adjusted for factors such as students’ learning capabilities and socioeconomic status.

If the number of first-, second-, and third-choice requests for all of its guides is high, a cluster gets a certain percentage increase in money for its guides’ salary rates (regardless of how many students the guides accept), which provides an incentive for all guides to improve and for the best guides to remain in teaching. The Consumer Aid Agency helps to keep this request process from turning into a popularity contest by providing *Consumer Reports*-type ratings on all guides. Guides can choose to take a reduced load, or some may be forced to if they are in low demand. This mirrors the workload dynamic of other professions.

Competition among clusters can have negative effects unless the system is designed to avoid them. Therefore, the salary supplement for each cluster varies with the demand for its guides, not the salary supplement for each guide directly. The distribution of any salary supplement is determined collectively by the cluster guides, and a cluster’s guides collectively decide how to spend their budget. This combines the benefits of competition among clusters (providing incentives for excellence and responsiveness to the community’s diverse and changing desires and needs) and cooperation within each cluster (providing support and encouragement among guides).

Excluding the direct revenues for the guides’ salaries, the revenue per child is equal across all clusters for a given developmental level, except for supplements for special-needs children and socioeconomic status. A cluster has full authority to decide how it spends that money, including the amount of space it rents from the school district, the amount of learning resources it buys or rents, and the number and type of support people it hires. In this regard, clusters are much like a charter school or private school.

A cluster whose guides are in high demand is able to accept more students, hire more support personnel, and even hire (or promote from within) new guides. On the other hand, a cluster with guides in low demand receives less salary money to split among its guides, and its guides receive less than a full salary if they don’t have a full load of students. Therefore, a guide who is not successful receives less money and may decide to look for another job. In this way, personnel hiring and firing are separated from a bureaucracy-based decision-making process; these functions are replaced by an automatic client-based system that allows for constant adjustment to the changing needs of the community—and also lowers bureaucratic costs.

A rating mechanism allows other clients of education, such as employers and senior citizens, to provide input to the client-based decision-making system. This is done with a product rating system, similar to that used by Amazon, for rating individual guides or their clusters, which influences students’ or parents’ selection of guides.

Incubation policies encourage the formation of new clusters and learning centers. If a group of guides solicits enough parent signatures to support creation of a new cluster or learning center, the Cluster Support Agency or the Learning Center Support Agency assists in its creation with a grant for startup funds and expertise to plan and start operations. These agencies are described in greater detail later in the “Administrative Structures” section.

With several clusters in a single school building, parents and students have choice without needing to leave their neighborhood school. Further, students and parents have some choice about what to learn and how to learn as part of self-directed learning (described in “Core Idea 4: New Roles for Students”).

Our current educational system is highly resistant to change, making a crisis necessary for significant change to occur. To avoid designing an Information Age system equally resistant to change, the new paradigm we envision is a self-adjusting learning organization. Crises are minimized because change is continuous and client-driven. Guides are in charge of adapting their practices to the changing educational needs of the community and students, rather than administrators and politicians controlling the changes.

Choice for Guides

Guides have choice about which cluster or learning center to apply to and, thus, to some degree, which other guides to work with. Of course, the guides in any given cluster or learning center have complete choice as to how many and which guides to hire. A guide can try to move to a different cluster at any time, and a guide can choose his developmental level and focus area. The new system removes these decisions from the bureaucracy-based decision-making process.

Administrative Structures

A district-wide administrative system facilitates the efforts of the clusters and learning centers. This system is designed to support rather than to control.

The Cluster Support Agency manages and supports the incubation of new clusters and may be contracted by existing clusters to provide support services to them—budget management, purchasing support, maintenance services, or transportation, for example. These services are outsourced to private contractors by the Cluster Support Agency at a group-negotiated rate.

The Learning Center Support Agency serves the same functions for the learning centers. Clusters and learning centers may opt out of these services and hire others better able to serve their needs. Both district-wide support agencies depend entirely on fee income from the clusters and learning centers for their budgets, except for the incubation services portion, which comes di-

rectly from the state; the agencies' income is based on the number of students they serve.

Alternatively, the Cluster Support Agency and the Learning Center Support Agency may be combined into a single agency to serve both clusters and learning centers, depending on the size of a particular school district.

The independent Consumer Aid Agency serves as a placement counseling service for matching children with guides. It provides diagnostic testing and interviews with students to help parents make the best decisions when choosing guides—and to actually make the choices for parents who don't want to participate in this process. This assistance can help to break the cycle of poverty by ensuring that all students are well matched with a guide.

This agency also serves as a watchdog service for collecting and disseminating information about the performance of clusters, guides, learning centers, and support agencies.

The PIES technology system (see “Core Idea 3: Technology and Other Resources”) automatically analyzes the quality of its instructional tools. Measures of performance for each guide and cluster (in terms of student attainment of standards and other factors) are prepared by the agency and are available to parents and students. User ratings are also maintained to further help students and parents make good choices. Similar measures of each learning center's performance are prepared for cluster guides and students. Guides in the clusters and learning centers can also access this information so that they can make improvements.

The Consumer Aid Agency's budget comes directly from the state and is based on the number of students it serves, which keeps it independent and unbiased.

Governance Structures

On both the community and state levels of governance, the Information Age structure differs from the current Industrial Age system. Local district school boards set and monitor the attainment of community standards, and they oversee facilitation efforts of individual units (clusters, learning centers, and district support units). The district board also serves as a citizen review board that adjudicates disputes among stakeholders (guides, parents, students) and protects the rights of disadvantaged students. The district board does not micromanage the affairs of the educational system. The client-driven decision-making system provides local accountability in educational decisions.

Funding the district board may happen in several different ways. A fee or tax paid by all clusters based on revenues might be effective, or allocations from local property taxes might be the best option.

The state department of education in the Information Age paradigm sets statewide standards and monitors their attainment. The department no longer micromanages local systems or dictates how specific districts or schools achieve standards; instead the state department uses incentive systems and contingencies to correct deficiencies in standards attainment.

The department also functions as the money mover by managing an equitable revenue collection and distribution system. Money goes directly from the state to each cluster (bypassing the district board) through a formula based on the number of students, the age of each student, any special needs each student may have, and a supplement for socioeconomically disadvantaged students. A state-level review board is in place for cases that the district boards cannot resolve.

Property taxes are the most *regressive* way to support public education. In the current systems, lower-income people end up paying a larger proportion of their income to school taxes, and communities with fewer businesses are at a disadvantage. However, state income tax revenues fluctuate considerably from economic expansion to recession, and the periodic huge budget cutbacks have a strongly negative effect on schools.

One solution is to fund education with a dedicated portion of the state income tax, but this approach would require a reserve representing a certain percent of the annual education budget during years of economic expansion to be used to maintain the budget during years of reduced tax revenues.

Another solution is to use property taxes to fund education, but to set tax rates on a sliding scale, so less expensive single-family dwellings are charged a lower tax rate. However, this does not address the inequities inherent in some communities being poorer than others or having fewer businesses that pay school property taxes.

The new paradigm must find a revenue system that is both more stable throughout the economic cycle and more equitable across communities of differing means to support it.

Collaboration with Family Service Systems

Family services are more important than ever in modern society. Raising children is just more difficult in this age of complexity. Everything from installing a child car seat correctly and monitoring your child's use of the Internet to avoiding child predators and promoting good nutrition and exercise weighs heavily on many parents who also are typically working full time, volunteering with their children's activities, and trying to carve out a little time for themselves, friends, and each other.

With so many conflicting opinions, expectations, and studies out there, parents increasingly need a reliable source of information, someone to turn

to with questions about parenting, health services, and much more. Social service agencies and schools need to collaborate more than ever before.

To meet the real needs of students in the Information Age, we think broadly of school systems as systems of learning and human development. This results in considerable overlap with traditional family service systems at both the community and state levels. Therefore, the new paradigm integrates services for newborns through five-year-old children and their families. The Independence (MO) School District has implemented such a collaboration for students and their families.

Family services include healthcare, parent education, counseling, childcare services for working parents, and family literacy efforts. In the new paradigm, most of these services are based in the cluster with caseworkers; healthcare workers provide some services in the school building and some at children's homes.

The school is the one place with which a majority of families associate for an extended period. The new paradigm maximizes the opportunities for leveraging that contact to shore up the family's resources and commitment to education and thus maximize the positive experience of children in schools.

A Learning Cooperative

The clusters and learning centers are a community learning hub that operates in partnership with the public library and functions as a learning destination for all members of the community. Individuals over the age of eighteen must earn credits to use the center by donating time to helping others learn, providing childcare services, volunteering in the cafeteria, providing custodial or maintenance services, or contributing to the operation of the clusters or learning centers in some other way.

Schools can thus be open to students from early in the morning to late at night, seven days a week, and the community's adults have flexible and affordable opportunities to advance their job skills, parenting skills, and other information needs, which strengthens communities.

Furthermore, community members support student learning in the community and in the clusters and learning centers. Students occasionally work with adult community mentors on projects involving service learning. To ensure this functions in a safe and reliable manner, all adults who provide such volunteer services to the school must pass appropriate background checks, and related liability insurance and legal issues must be addressed. But assuming that those logistics are handled appropriately, the learning cooperative concept goes far to lower the cost of public education and make it an effective educational system that truly serves the public.

Most of the core ideas of the Information Age education paradigm are supported by current research on human development and learning processes. Some of the ideas need revision; some are likely to vary at implementation from one community to another and even from one cluster to another within a community; and most need to be further operationalized. But we hope this vision provides a useful reference to help you jump out of the Industrial Age mindset about education and join the effort to reshape the U.S. educational paradigm into a working system that meets the real needs of students and communities living in the Information Age.

STRUCTURAL CHANGES

The six core ideas of the Information Age education paradigm have important implications for the structure of education systems. To examine these implications, first consider the structural features of the Industrial Age paradigm:

- grade levels
- class periods
- classrooms
- courses
- grades

It may seem hard to imagine a school system without these features, but none of them existed in the agrarian age paradigm of the one-room schoolhouse. They met important needs during the Industrial Age but are obsolete in the modern age. Further, these components of current education systems may actually be the source of problems with the current state of education.

- *Grade levels* are incompatible with the new paradigm because individual students learn at different rates and become ready to move on to different attainments at different times. Grade levels are a key feature of the time-based, sorting-focused paradigm that served us well during the Industrial Age, but they are detrimental to meeting Information Age educational needs.
- *Class periods* often cut learning short before a “learning episode” has had the opportunity to play itself out to a successful conclusion. Fixed time serves the sorting-focused paradigm well but is a detriment to the learning-focused paradigm.
- *Classrooms* are designed for a single teacher to work with a group of twenty-five or more students. For the new paradigm, spaces designed for

collaboration among guides as well as among students are imperative. Learning spaces must be full of rich resources (including technology) and project workspaces.

- *Courses* provide little flexibility for students to choose what to learn. It is more useful to think in terms of small units or modules of specific attainments and how to certify understanding.
- *Grades* function primarily to compare students to each other. Grades do not reveal what a student has learned. They are appropriate for a sorting-focused system but not for a learning-focused system genuinely committed to leaving no child behind.

Understanding that these structural features of the current paradigm are incompatible with the Information Age paradigm underscores the magnitude of the transformation required. Yet the six core ideas offer a sense of direction for the transformation, though the particulars of implementation may differ over time and from one school system to another.

Eventually, the education system that students need today and tomorrow will become clearer and gain momentum as it moves up its S-curve. Early versions of the new paradigm won't come close to reaching its potential, but they already outpace the current paradigm.

COST-EFFECTIVENESS

The Information Age paradigm offers greater effectiveness at lower cost than the factory model schools for these reasons:

- Attainment-based student progress enhances the effectiveness of the education system by avoiding huge wastes of time associated with holding back fast learners and the failures related to rushing slow learners and thereby ensuring that they accumulate gaps in their learning that make learning related material more difficult in the future.
- The increased motivation to learn that comes from project-based learning—when projects are strongly related to student interests—also improves the effectiveness of education efforts.
- Project-based learning that uses real-world projects results in better transfer of student skills to the real world.
- Eliminating layers of bureaucracy saves money, especially in larger, more bureaucratic school districts.
- Teaching support from aides and interns (beginning guides) allows lead guides on a developmental level to accept more students and still

provide students the personalized attention they need. This reduces costs per student.

- Self-directed learning, collaborative learning, and peer tutoring, all highly effective modes of learning, place fewer time demands on guides, so they can effectively serve more students, lowering the cost per student. Students are perhaps our most underutilized resource in education.
- The learning cooperative concept provides a way for parents, senior citizens, and other volunteers to play a much more meaningful role in helping students to learn. By encouraging volunteers to support the clusters and learning centers in exchange for access to the system's resources to further their own learning, adults in a community provide additional human contact while reducing labor costs and contributing to a greater sense of community.
- Increasingly cost-effective technology provides labor-saving instructional tools that allow guides to serve more students while still providing personalized learning and a caring learning environment.

Even if costs were not lower, the new paradigm is more effective at promoting student learning, so it would still be more cost-effective than the current paradigm.

Further, the social costs of inadequately preparing students for modern life include higher rates of crime, substance abuse, bullying, violence, and unethical behavior. The Information Age paradigm helps students build and maintain relationships, and develop social and emotional intelligence and strong ethical character; it also better prepares people for success in the workplace.

Chapter 3 describes how some schools are getting started with the Information Age paradigm, thereby showing how some different communities are implementing the six core ideas.

CHAPTER SUMMARY OF KEY IDEAS

- Core ideas for the new paradigm of education are based on the key characteristics and educational needs of the Information Age.
- These six core ideas for the Information Age education paradigm are described to stimulate thinking about what's possible for education, with the understanding that they may be implemented in many different ways in different communities.
- The six core ideas are summarized in table 2.1.
- Grades, grade levels, class periods, classrooms, and courses are all antithetical to the core ideas for the new paradigm.

Table 2.1. Core Ideas for the Learning-Focused Paradigm

Attainment-based system	Student progress	Each student must reach the standard before advancing and must be allowed to advance as soon as the standard is reached.
	Testing	Student assessment is both formative to assist learning and summative to certify individual mastery of each attainment. It does not produce grades, averages, or other student-to-student comparative measures.
	Student records	A record of attainments indicates what standards each student has attained (instead of grades), and each attainment may be linked to a portfolio item.
Learner-centered instruction	Personalized	Each student has a personal learning plan that customizes both content and methods to the individual's needs.
	Project-based	Students work on engaging, authentic projects that entail learning selected attainments.
	Collaborative	Students often work in small teams on the authentic projects.
	Individualized instructional support	Instructional support for project-based learning provides personalized tutorials for mastering skills just in time during the projects.
	Special needs	All children are special and fully integrated with the other children.
Expanded curriculum	SCANS	Basic skills
		Thinking skills and creativity
		Personal qualities
		Broad competencies
		Core subjects
	Twenty-first-century skills	Twenty-first-century interdisciplinary themes
		Learning and innovation skills
		Information, media and technology skills
		Life and career skills
	Holistic	All aspects of child development are addressed, including emotional, social, physical, and character as well as cognitive development.

(continued)

Table 2.1. (Continued)

New Roles	Teachers	Guides are caring mentors, designers (and/or selectors) of engaging student work, facilitators of student work, lifelong learners, and cluster owners.
	Students	Students are self-directed learners, teachers, and collaborative participants in learning.
	Parents	Parents are actively involved in both deciding what their child should learn and helping her learn it. Parents also have input into how the school operates.
	Technology and resources	Technology and hands-on resources play a central role to support planning, learning, assessment, recordkeeping, collaboration, and communication. Small learning communities help develop student responsibility, caring, and leadership, and they improve quality of life for staff.
A nurturing school culture	Small school size	Deep personal ties connect students, guides, parents, and the larger community.
	Strong relationships	Each student has a mentor guide for a developmental stage (about three years).
	Multiyear mentoring	A guide's students are evenly distributed across a developmental stage. Intrinsic motivation is nurtured by learning through authentic, engaging projects that are relevant to the students' lives and interests.
	Multiage grouping Enjoyable learning	Guides model lifelong learning by learning with, from, about, and for students.
	Guide learning	The school collaborates with social service agencies to provide specialized services to families.
	Family services	About four to ten guides own their own small public school.
Organizational structures	Schools as clusters Learning centers	Other guides own their own learning centers that students in all clusters can use to learn in different focus areas. Centers include "shopping-mall," community, and mobile centers.
	Choice for students and parents	Students and their parents have some choice of guide (and consequently cluster and school building) as well as some choice for what and how they learn. Demand for guides influences their pay. Bureaucracy is eliminated.
	Choice for guides	Guides have some choice of which other guides to work with and how their school is run.
	Administrative structures	A Cluster Support Agency and a Learning Center Support Agency support (don't control) the clusters and learning centers. A Consumer Aid Agency facilitates beneficial student and parent choices.
	Governance structures	Local district boards set and monitor community standards, adjudicate disputes, and advocate for clusters and learning centers. State boards and education departments set and monitor state standards, support local districts, and manage finances.
	Collaboration with other family service systems	The schools collaborate with many agencies to provide human services in school buildings.
	A learning cooperative	The schools are a learning hub where all members of the community may go to learn in exchange for donating skills and services.

- The new paradigm is more cost-effective than the factory model of schools because it uses attainment-based student progress (which avoids a huge waste of student time), uses project-based learning (which improves student motivation and transfer), eliminates the bureaucracy, uses aides and interns, uses self-directed learning and peer tutoring or collaboration, uses the learning cooperative concept, uses more technological tools and materials, and creates important social cost savings.

NOTES

1. IEPs are used mainly in special education.
2. *Intrinsic motivation* refers to motivation that comes from inside the student, in contrast to *external motivation*, which comes from external factors such as grades, praise, or money.

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- The Khan Academy: www.khanacademy.org
- The KnowledgeWorks Foundation: <http://knowledgeworks.org>
- The National School Boards Association's Center for Public Education: www.centerforpubliceducation.org
- The Nellie Mae Education Foundation: www.nmefoundation.org
- The New Commission on the Skills of the American Workforce: www.skillscommission.org
- Next Generation Learning Challenges: <http://nextgenlearning.org>
- The Partnership for 21st Century Skills: www.21stcenturyskills.org/
- The Secretary's Commission on Achieving Necessary Skills: wdr.doleta.gov/SCANS/whatwork/
- The Software and Information Industry Association: www.siiia.net
- The Virginia Council on Economic Education: www.vcee.org/programs-awards/view/3

Examples of the New Paradigm

The attainment-based paradigm that we envision for the Information Age is not new. It has been around in various forms for well over a century, thanks to visionary thinkers like Maria Montessori and John Dewey—as well as the Boy Scouts. But because this education paradigm is incompatible with an industrial age society and Industrial Age thinking, it has not yet become the predominant paradigm for education in the United States.

In this chapter we point out how the six core ideas in the Information Age education paradigm described in chapter 2 are being used by three kinds of school systems:

- an individual school, the Minnesota New Country School
- a school district, the Chugach School District
- a broad network of schools, the Montessori system

For each of these three case studies, we provide general information about the school system, evidence of the implemented features' effectiveness, a table showing the extent to which each of the six core ideas is evident, and a description of how the core ideas are implemented in the system.

An at-a-glance table comparing these three school systems is presented in appendix A.

MINNESOTA NEW COUNTRY SCHOOL (EDVISIONS)

The Minnesota New Country School (MNCS) is a public charter school located in Henderson, Minnesota. It was founded in 1994 and has about 110