Equipping Every Learner
for the 21st Century

Foreword

A question often posed to us at Cisco is why the private sector is so invested in education. The answer is simple, but multifaceted.

First, we know that education has been the ticket to opportunity and prosperity. It has enabled individuals, whether in developing or developed countries, to become academics, entrepreneurs, and business and government leaders.

Second, we recognize the challenges facing education systems have a direct impact on our future as a corporation. Sustainability for us depends on the innovation and expertise of our employees. Our priority will always be the recruitment and retention of top talent. While many corporations invest heavily in ongoing education and skills training of employees, they still depend on the solid foundation taught during primary, secondary, and tertiary education. In essence, we are consumers of the talent developed by education systems. Thus we, like many of our peers, have engaged in strategic initiatives for education reform in partnership with the public sector, the education sector, and communities around the world.

Finally, we know that although today's global, Internet-based economy provides numerous opportunities not available before, there is still a critical need for universal access to quality education and visionary leadership. Significant barriers remain to achieve this, from gender inequality to a lack of basic capacity, and we are involved in many initiatives to counter precisely these problems. This paper strives to address the holistic transformation of education systems and to offer a foundation on which quality education and system leadership can be achieved.

The objective within this document is to initiate an informed dialogue among education thought leaders and practitioners on the path to 21st century learning. Our point of view is based on direct experience with various education initiatives and research into education reform models. We believe the core of an excellent education system is based on talented teachers, strong system leadership, solid curriculum, and accountability for outcomes. However, another key component is the integration of technologies that can fuel new forms of teaching and learning, nurture 21st century skills, and prepare learners for participation in the global economy of this century.

The core ideas were initiated by Cisco's internal education strategists, but we have worked with many others to validate, develop, and refine them: including Sir Michael Barber, author of "How the World's Best Performing School Systems Come Out on Top" (with Mona Mourshed, McKinsey, 2007); and Tony Mackay, director of the Melbourne-based Centre for Strategic Education. We have also consulted with CoSN, P21, and ISTE, which together represent a broad swath of expert opinion across the United States.

We have involved a number of expert reviewers with a global perspective. They include:

India

- Mr. Ashok Ganguly, Chairman,
  Central Board of Secondary Education, an autonomous organization under the Ministry of Human Resource Development, Government of India

- Professor Fazal Rizvi, Director,
  Global Studies in Education, University of Illinois, USA

Republic of Korea

- Professor Lee Okhwa, Professor in Education,
  Chungbuk National University, Member of the Presidential Committee for Educational Innovation Korea Education 2030

China

- Professor Yong Zhao, University Distinguished Professor
  of Educational Psychology and Educational Technology, Director Center for Teaching and Technology, Director US-China Center for Research on Educational Excellence, Michigan State University, USA

Hong Kong

- Mr. Chris Wardlaw, Deputy Secretary,
  Education and Manpower Bureau, Hong Kong

UK

- Sir Alan Wilson, former Vice Chancellor of Leeds University and Director General Higher Education, Department for Education and Skills

Australia

- Vic Zbar and Kathe Kirby, Centre for Strategic Education

In 1997, Cisco launched the Networking Academy® program in an attempt to address a small slice of the skills gap issue in the knowledge economy. While many countries had solid institutions focused on "vocational" training, the jobs emerging in the late 1990's required a transition from the skills needed in the industrial economy to those relevant in a connected knowledge economy. Our objective was to pilot Networking Academy in a small number of U.S. states that were active in addressing this emerging skills gap in information and communications technology (ICT). Over the last 10 years, the Academy has scaled to over 160 countries, with a strong focus on gender equality and student outcomes. A prerequisite to entry into the program was a solid grounding in the core areas of math and literacy. We found that many students lacked these basic skills, which became the incentive for us to become further engaged in supporting basic education enhancements. Concurrent to the Academy program, Cisco's business was also expanding rapidly and we experienced firsthand the competition for talent in local and global markets. Through our participation in local education initiatives, we learned that:

(1) Technology had the potential to increase access to education as well as improve teacher training and student learning;

(2) Sustainability of quality education and access to it needed a multi-stakeholder approach that included government officials, education leaders, teachers, private sector investments, and non-governmental organizations (NGOs) to address many of the basic needs and barriers to education.

These realizations helped guide our approach to two subsequent engagements. The first was the Jordan Education Initiative (JEI), launched in 2003 with the World Economic Forum. This was a collaboration designed to bridge the education gap between developed and developing countries through the use of ICT. It brought together seventeen global companies, including Cisco, Hewlett-Packard, Intel, and Microsoft; seventeen local Jordanian companies, such as Fastlink and Rubicon; the Jordanian government; and key education thought leaders and NGOs. The second engagement was the three-year 21st Century Schools Initiative (21S), launched in Mississippi and Louisiana in partnership with the State Superintendent of Schools, local school districts and teachers, principals, and the local community to address teaching and learning in the 21st century. As a result, we have established quality external assessment programs to measure progress, captured best practices, and identified areas for improvement to help design potential replication models in the future.

Through this work we have gained a healthy respect for the challenges educators and education system leaders face—teaching the skills required to compete in the 21st century economy. In addition to ensuring student attainment of core STEM skills, we have found it increasingly important to nurture the development of 21st century skills such as innovation, collaboration, problem solving, and self-direction to help ensure success in the workplace. We continually partner with and implement feedback from instructors and the education community, and we believe the success of programs in which we have been involved is a direct result of collaborative, multi-stakeholder partnerships.

Our ongoing engagements with education thought leaders and practitioners in both developed and emerging countries have also led us to the realization that the time is right for creating a holistic approach to a system transformation. Outlined in this white paper are ideas that encompass the aspirations of those mentioned above. Our next step is to engage in a dialogue with a broad community of policy makers, thought leaders, and ministers of education, and propose an action plan for the future of education.

> — Tae Yoo
> Senior Vice President, Corporate Affairs
> Cisco, San Jose, California

Executive Summary

Equipping Every Learner for the 21st Century

The future growth and stability of our global economy depends on the ability of education systems around the world to prepare all students for career opportunities and help them attain higher levels of achievement. However, despite numerous efforts to improve educational standards, school systems around the world are struggling to meet the demands of 21st century learners and employers.

In both developed and developing nations, young people have become increasingly reliant on social networking technologies to connect, collaborate, learn, and create, and employers have begun to seek out new skills to increase their competitiveness in a global marketplace. Education, meanwhile, has changed much less. With few exceptions, schools have yet to revise their pedagogy to reflect current trends and technologies.

The complexity of this challenge calls for a bold and timely response—a global solution that allows poorer countries to leapfrog costly stages in the development and expansion of their education systems, while enabling schools around the world to incorporate 21st century skills into demanding curricula.

This paper proposes a new paradigm of 21st century learning; one that will require a holistic transformation of education systems. It will be guided by a comprehensive roadmap of curricular and assessment reform, new teacher recruitment and training strategies, leadership development, and the integration of collaborative technologies. It will be facilitated by exceptional teachers and supported by technologies that allow individuals to create, adapt, and share content. Students will complete project-based, cross-disciplinary tasks that encourage innovation and cross-cultural collaboration, and apply their knowledge and creativity to solving real-world problems.

Although the vision is global, the path to 21st century education requires a local journey; one that recognizes and responds to specific challenges and opportunities. The end goal is the systemic improvement of both the quality and accessibility of education throughout the world.

Equipping Every Learner for the 21st Century: A White Paper

The Challenge

The High Cost of Low Performance

Education has long been seen as a fundamental component of human well-being and national productivity. Although education cannot carry the blame for every country's problems, it is surely a critical part of the solution. Compare the GDP per capita of three countries: the United States, India, and Mozambique, at US$37,000, $3000, and $1000 respectively. On average, children in the United States attend school for 12 years; compared to 5 years in India and 1 year in Mozambique.[1] Within these countries, the contrast in fortunes between those with access to good education, and those without is stark.

In the developed world, education has played a central role in election campaigns. In the United Kingdom, for example, Tony Blair ran on a platform of "education, education, education" and the newly elected government in Australia has touted an "education revolution" as the centerpiece of its campaign. In the developing world, access to basic education is a pressing need, especially in countries where widely dispersed populations live in acute poverty. In 2002, more than 75 percent of the world's poor lived in rural areas. This amounts to 883 million people living on less than $1 per day and more than two billion people living on less than $2 per day.[2] In the least developed countries in Africa, as well as in parts of Asia and South America, the task of providing basic education to all citizens poses a major challenge, as the UN Millennium Development Goals recognize

In addition to access challenges, the quality of education is an important consideration. Only high-quality education offers a way out of the vicious cycle of endemic poverty that limits educational standards, constrains economic development, and drives away talent. In today's global market, brain drains are hard to avoid. For example, 48 percent of Indonesia's 1.8 million emigrants are highly skilled, as are 55 percent of Nigeria's 0.2 million emigrants.[3] This is talent that no country can afford to lose, and improved education standards can help stem the tide. The challenge is one not only for schools but for the tertiary education sector as well, which has arguably struggled to achieve the twin aims of excellent teaching and high-level research scholarship to meet 21st century social and economic needs.
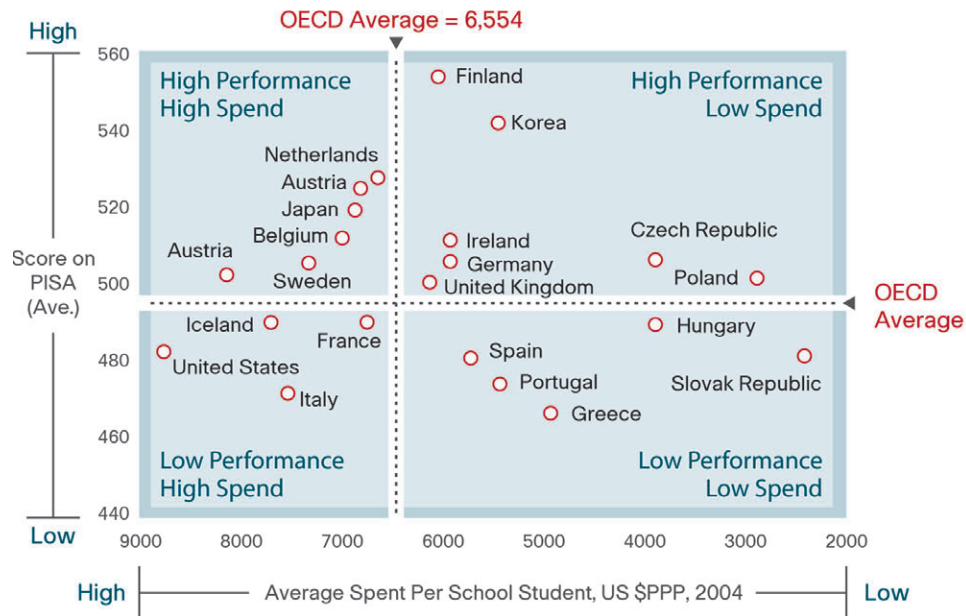
Small wonder then that the emerging world is now focusing on educational quality and student outcomes. An example is China, which, after expanding its capacity by more than 12 million students from 1999 to 2004, is now addressing ways to improve the quality of education. According to the Deputy Minister of Education in China, "The ministry will focus on improving the quality and conditions of higher education rather than increasing the number of students."[4] In India, the government's vision is to build on its constitutional mandate for universal elementary education by ensuring access to quality secondary education for all students aged 15-16 by 2015 through its Scheme for Universalization of Access to Secondary Education (SUCCESS).

Return on investment

If these countries are looking for answers from the developed world, they are in for a shock. Many developed education systems have made enormous increases in spending for scant return. In the past 25 years, spending per school pupil in the United States has increased by more than 70 percent, resulting in more teachers and smaller classes. Literacy rates, however, have remained unchanged and mathematics scores have shown only modest improvements.[5]

This demonstrates that money alone cannot buy educational success. Among OECD countries, Italy and the United States are spending much more per pupil than Finland and Korea, yet are achieving much poorer results.[6] Exhibit 1 plots the performance by countries in PISA 2006 tests against their spend per pupil; indicating a stark contrast between high performance/low spending systems and their low performance/high spending peers.[7]
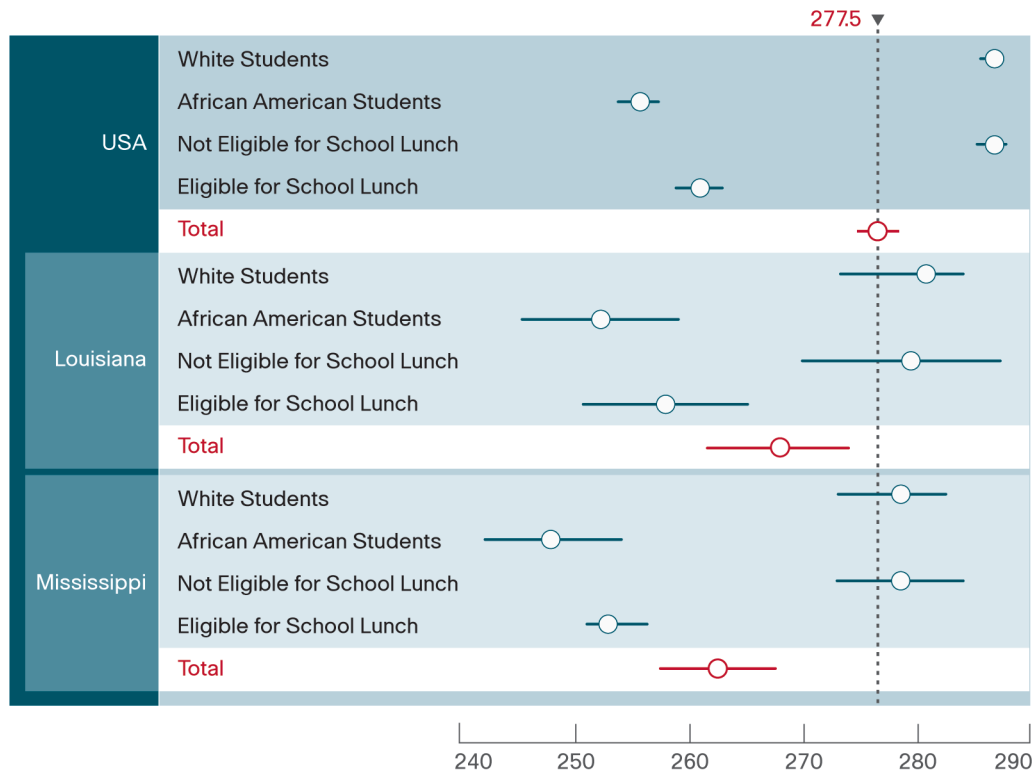
Exhibit 1:
Many countries face high spending and low performance

Source: OCED education at a glance (2007) primary and secondary average spend per student; Pisa 2006; team analysis

Low comparative achievement often triggers further spending, with millions of dollars going into remediation and workplace training to repair the perceived deficiencies.[8] Estimates in the United States suggest that more than 40 percent of recent public high school graduates are neither prepared for college-level classes nor equipped with skills to advance beyond entry-level jobs.[9]

Nevertheless, money can make a difference within each country. Where you live and what you earn will impact your children's opportunities for success. In the United States, for instance, there is chronic underachievement in relatively poor states such as Mississippi and Louisiana. At the same time, ethnic minorities and students from low-income homes perform below national averages in almost all states, as shown in Exhibit 2.[10] It is important to address these inequities and ensure that "every child, rather than just some children, has access to excellent instruction."[11]

Note: School lunch eligibility implies low family income. Spread based on 5 standard errors in either direction from mean

Source: NAEP (2005)

The critical differentiator between successful and unsuccessful systems appears to be how the money is spent. Systems characterized by enormous increases in spending for little return have failed to target the educational strategies that are proven to produce the best results. Research conducted by John Hattie from Auckland University quantifies the effects of various strategies and demonstrates the relatively low impact of common, often expensive policy responses such as lowering class sizes.[12] Hattie's research also suggests that investing in the quality of teachers has a significant positive effect because aside from what students bring to school, teachers and teaching have the biggest impact on learning outcomes. The critical importance of great teaching may seem somewhat obvious, yet this importance is not reflected in the strategies employed by many education systems.

System reform movement

An education reform movement began in the 1980s and slowly took hold around the world, with landmark reports drawing attention to the issue such as "Nation at Risk" in the United States in 1983. This movement set out to enhance the professionalism and capabilities of school systems to meet higher academic standards. There is now an emerging consensus on the resources needed to build a well-functioning education system. These are exceptional teachers and teaching methods, relevant and stretching curricular content, accountability for outcomes, and outstanding system leadership,[13] as shown in Exhibit 3.

Teachers
Attract and Develop Very High-Quality Teachers

Attract among top 30 percent of graduates

Improve instruction through coaching, practical training, enabling teachers to learn from each other, and supporting the adoption of pedagogical practices that have been proven to work

Curriculum
Develop Well-Defined and Holistic Curricula

Set Challenging Objectives for teachers and students by creating specific and well-articulated outcome objectives

Create curricula with a strong focus on math skills and literacy in the early years, and relevant content and high standards at all levels

Leadership
Develop High-Quality System Leadership

Get the right teachers to become principals

Develop instructional leadership skills

Focus principals' time on instructional leadership

Promote distributed leadership approaches in systems and schools

Accountability
Create Practices and Regimes That Can Improve Processes and Outcomes

Foster excellence and accountability at all levels of schooling

Use independent bodies to track examination and school performance and intervene quickly

Education Reform

Fortunately, there are pockets of success—shining lights within systems where reform is yielding results. Finland is one example, where better outcomes for lower spending are often attributed to an investment in great teachers, improved curricula, and rigorous accountability; built on a tradition of high levels of respect for education and teachers that the government actively promotes. Elsewhere, there are examples of progress in the most challenging circumstances. After a top-down phase of improving the basics, New York City has embarked on a bolder reform strategy, in which money and responsibility have been delegated to school principals. All schools are held accountable for their results and periodically publish performance reports that indicate how they compare to others in the city on a range of different measures.[14]

As with most system-wide reforms, the core challenge is scaling up; replicating successful practices and systematizing great teaching to make it available throughout the system. So far, school system reform is far from universal. It has taken root in a limited number of countries, and in only some districts and schools within them. This is especially true in developing countries such as India, where there are sharp disparities between different social and economic groups and the emergence of pockets of excellence has only exacerbated these inequities. This is why the policy framework in developing countries should aim to ensure comparable, high-quality learning opportunities and experiences for students in all schools.

Even if improvements occurred universally, however, events outside the education system suggest they would not be enough. The next section explains why the reform agenda is indeed necessary, but no longer sufficient.

A Paradigm Shift

A lesson learned in recent years is that leaders need to be wary of designing a reform agenda that fails to account for the changes taking place outside the school gates. While education systems have been making incremental progress, learners' experiences and attitudes have been changing radically and governments, employers, and non-government organizations have all begun to seek out different skill sets.

Learners are changing

How can traditional modes of classroom instruction engage and inspire students when life outside the classroom has changed so dramatically? In 2007, teens in the United States spent 40 percent of their media time on cell phones, the Internet, and games, up from 16 percent in 1998.[15] For many learners, class is the only time in their day when they completely "disconnect." Exhibit 4 illustrates this trend for the average Dutch student.
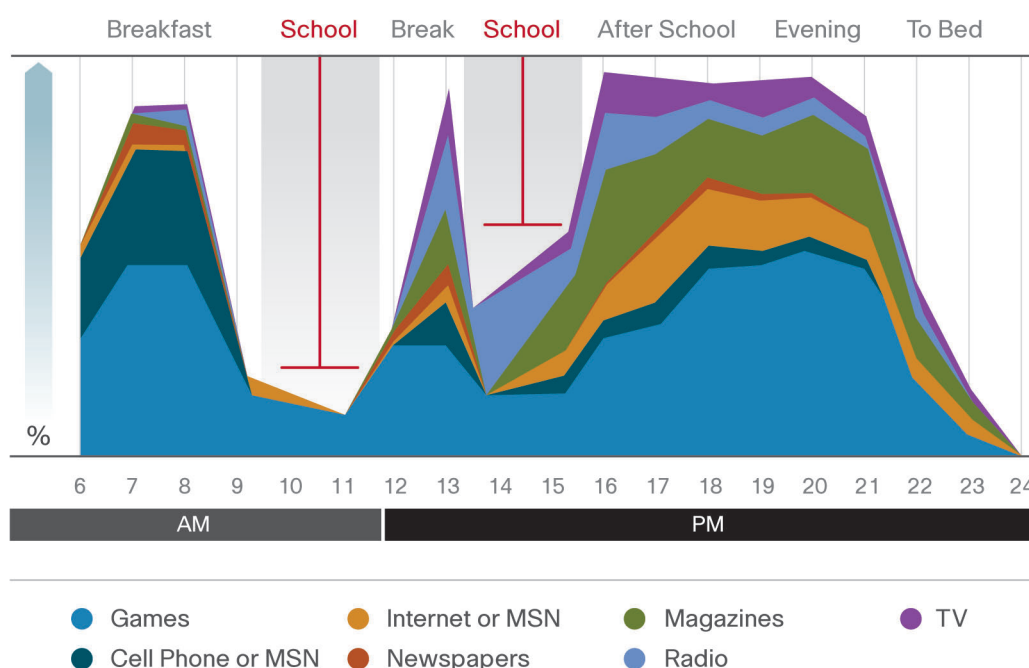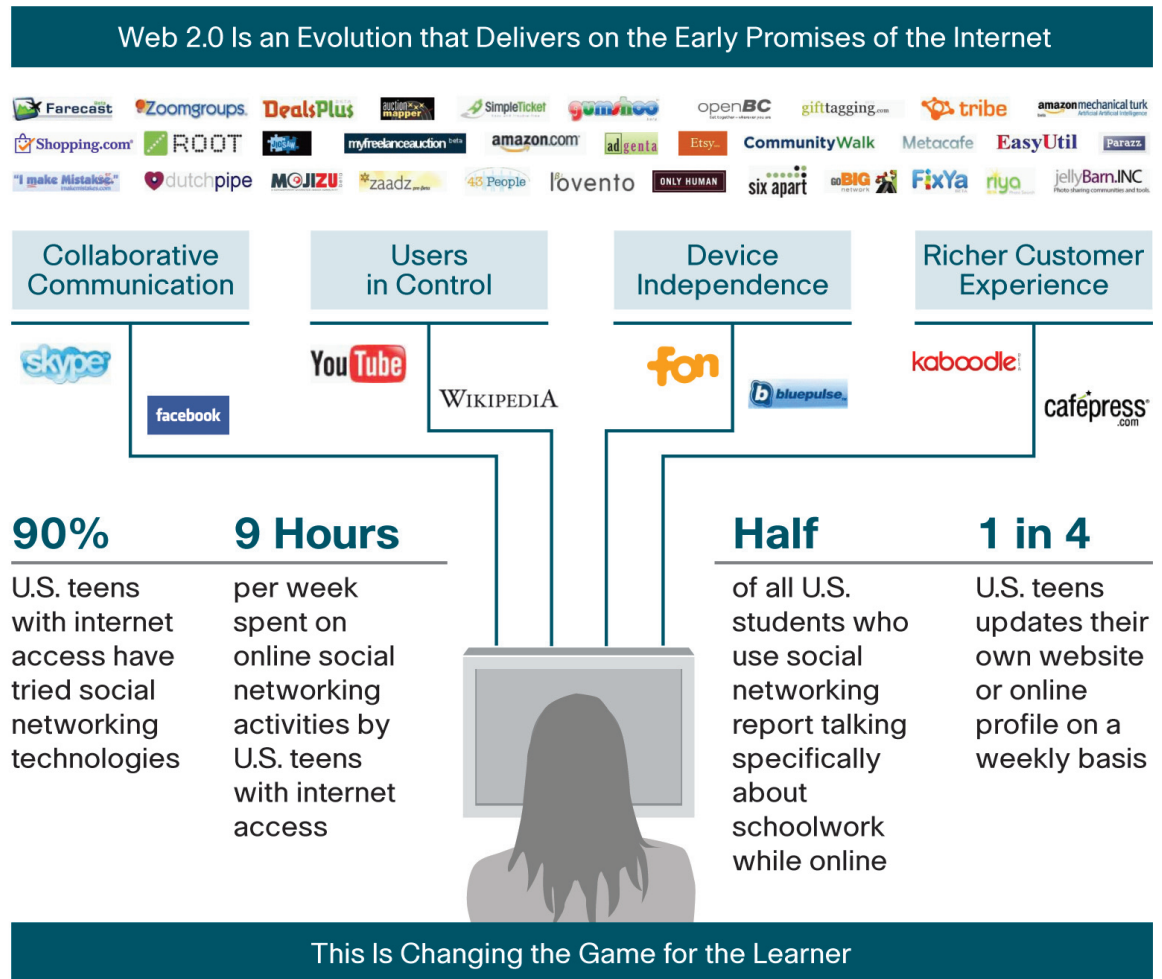
Media Consumption by Percent

Legend:
- Games
- Cell Phone or MSN
- Internet or MSN
- Newspapers
- Magazines
- Radio
- TV

Source: Cisco 2007

More recently, the Web 2.0 phenomenon of online social networking has swept the globe, as shown in Exhibit 5. MySpace, Facebook, and Orkut grew by 72 percent, 270 percent, and 78 percent respectively in 2006, and collectively have 190 million unique users around the world.[16] Now everyone can be a creator—a film maker on YouTube, a recording artist on Second Life, or an opinion leader on blogs and a multitude of gossip and comment sites.

Web 2.0 Is an Evolution that Delivers on the Early Promises of the Internet

| Collaborative Communication | Users in Control | Device Independence | Richer Customer Experience |

90%

U.S. teens with internet access have tried social networking technologies

9 Hours

per week spent on online social networking activities by U.S. teens with internet access

Half

of all U.S. students who use social networking report talking specifically about schoolwork while online

1 in 4

U.S. teens updates their own website or online profile on a weekly basis

This Is Changing the Game for the Learner

The rapid changes and opportunities brought about by Web 2.0, which were initially limited to more affluent societies, are increasingly affecting the whole world. More than one billion people use the Internet globally, and more than half of them live outside the United States and Europe.[17] Mobile phones are used by more than 2.7 billion people, and some of the fastest growth in wireless technology use is in Africa.[18] In India and China, social networking sites are expected to grow from 33 million users in 2004 to 90 million by 2008.[19] Despite these trends, there are limited opportunities to leverage the creative and collaborative capabilities of Web 2.0 technologies in the classroom.

Employers need new skills

Employers are also changing and confronting the realities of globalization. According to the New Commission on the Skills of the American Workforce:

A swiftly rising number of American workers at every skill level are in direct competition with workers in every corner of the globe... The best employers the world over will be looking for the most competent, most creative, and most innovative people on the face of the earth and will be willing to pay top dollar for their services. This will be true not just for top professional managers but up and down... the workforce. Those countries that produce the most important new products and services can capture a premium in world markets that will enable them to pay high wages to their citizens.[20]
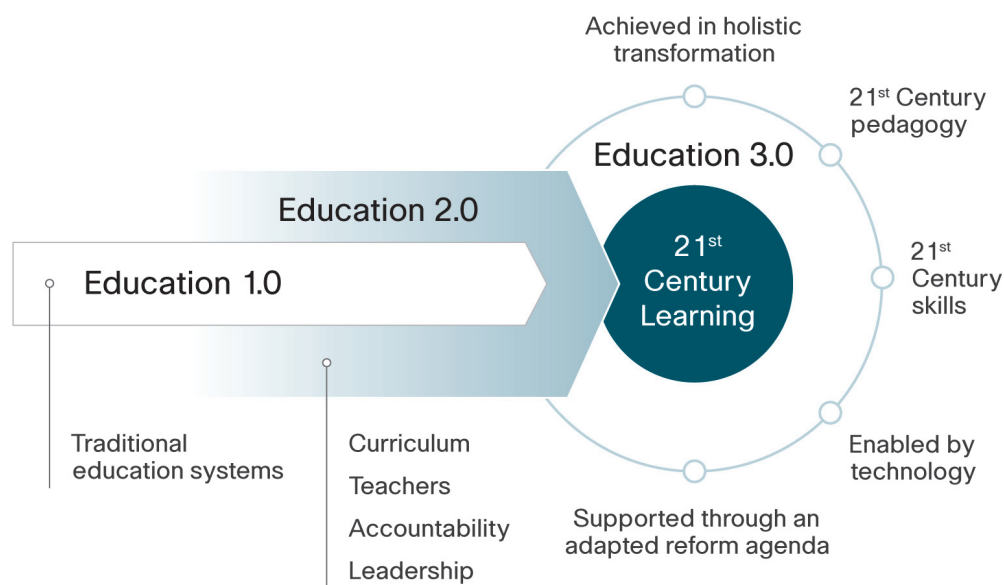
The importance placed on creativity is matched by a need for employees to be far more adept at collaboration. As many as 70 percent of new jobs created in the United States from 1998 to 2004 were "interaction intensive" occupations such as insurance, banking, and health care, which rely on interactions between people and involve judgment, insight, and collaboration. This trend is replicated in other parts of the world. Wages for these types of jobs have risen faster than the economy as a whole, suggesting that those who are prepared for an interaction-oriented economy will have a competitive advantage.[21] The fact that these interactions increasingly occur on a global scale also puts a premium on cross-cultural knowledge and understanding, such as multilingualism and upholding the values of tolerance, understanding, and respect.

This is not to say that core competencies such as mathematics and literacy no longer matter to employers. On the contrary, surveys of employers repeatedly indicate that they remain vital[22] and research has shown a strong correlation between an early focus on numeracy and literacy and higher earnings in later years. Although these basics are prerequisites for success in the workplace, employers tend to regard them as the price of entry, rather than the source of a competitive advantage.

In the developing world, a similar pattern is emerging. As economies develop, the job market shifts from low-interaction occupations such as basic manufacturing to more globalized sectors, with formerly isolated activities such as agriculture becoming more connected through global, online markets; thereby increasing the demand for 21st century skills. The effects of these shifts are apparent, for example, in China, where employers are currently experiencing a shortage of competent senior managers.[23] Employers in the Middle East also report a shortage of critical skills in graduates such as practical experience and problem solving,[24] and in some rapidly-growing economies, employers are providing pre-job training to address a perceived lack of employable skills.

Can education adapt?

These trends, which occur in similar ways across different societies, have led learners, employers, and global citizens to demand more from their education systems. Satisfying them will require system leaders to embark on a paradigm shift, as illustrated in Exhibit 6.

Exhibit 6:

Education 3.0: A paradigm shift

To borrow from technology parlance, Education 1.0 represents education as it was during most of the 20th century, characterized by access and quality challenges, variable practices and standards, and limited performance management. In the Education 2.0 phase, system reforms have been designed to professionalize processes, set standards, and upgrade capabilities. Education 3.0 is the emerging paradigm of 21st century learning. It builds on the system reform of Education 2.0 and the opportunities afforded by Web 2.0 to equip learners with new skills by introducing new pedagogy.

This new paradigm requires a broader reform agenda; one that responds to socioeconomic realities and enhances learning opportunities through collaborative technologies. It presents a global destination with many different local paths. In Hong Kong, for example, the broad program of education reform initiated in 2000 has included an effort to infuse project skills into all key learning areas, and thereby provide a strong incentive for teachers to use digital learning resources in their work.[25] In developing countries with limited access to formal schooling, Education 3.0 could potentially provide new access to quality teaching and learning materials, expert practitioners, and global support networks, in a range of specialized domains.

Similarly, 21st century learning is imperative for rapidly-growing countries such as India and China to move toward a knowledge economy. If China, India, Indonesia, and Nigeria aspired to reach U.S. levels of participation in the education system, they would need to add more than 200 million spaces in primary, secondary, and tertiary education and as many as 10 million teachers.[26]

Twenty-first century learning will also benefit somewhat didactic systems in Asia and elsewhere, where rote learning has traditionally dominated. Even when these systems produce high test scores, questions arise as to whether or not the students graduate with the skill sets that employers need, especially for interaction-intensive industries.[27] On the other hand, some Western nations have made progress in "soft skills" development, even though their PISA rankings are comparatively low.

Collaboration and creativity

Collaboration and creativity are emblematic of this paradigm shift and will direct the course of the Education 3.0 reform agenda. They are already the tools of today's learners and employers, and should logically become the tools of today's teachers, schools, and education systems as a whole.

The best educators around the world already teach this way. They encourage learners to work in teams to solve problems, deepen their understanding of various concepts, and increase their knowledge. This in turn generates the skills employers seek: expertise, creativity, interdisciplinary thinking, and team-based problem solving; resulting in a more innovative workforce and thereby stimulating economic development.

Some schools already support 21st century learning; but there are relatively few examples around the world. The primary challenge therefore is to replicate these models of excellence and systematize great 21st century learning to make it available to all.

The Approach

Finding the Path to 21st Century Learning

Holistic transformation

The paradigm shift to a world of 21st century learning is rooted in a set of goals for all learners:

· Acquire a range of skills needed to succeed in a modern, globalized world

· Receive tailored instruction that enables them to reach their full potential

· Connect to their communities in person and digitally, and interact with people from different cultures

· Continue learning throughout their lives

To achieve this vision, a transformation will need to occur in four interconnected core areas, as shown in Exhibit 7. The first is 21st century skills that complement the core curriculum. The second is 21st century pedagogy to teach these skills effectively alongside basic literacy and numeracy skills. The third, which is a crucial enabler of both the new pedagogy and skills, is technology, harnessed in a much more fundamental and effective way than traditional applications in education. The fourth is 21st century system reform that integrates and adapts the pillars of high performing systems outlined earlier—great teachers, curricular excellence, accountability for outcomes, and outstanding system leadership.

This transformation and the many interventions that will be necessary to achieve it must be pursued holistically. Progress will only occur when all four areas are leveraged and deployed to work together in an integrated way. Leading technologies, for instance, cannot replace teachers, but can support them in accomplishing much higher levels of student engagement and achievement. Similarly, great teachers cannot effectively reach young learners without adopting new pedagogies that align with Web 2.0 principles, and few education systems can prepare their learners for prosperity without supporting the development of 21st century skills.

Exhibit 7:

The path to 21st century learning

21st century skills

A number of programs already address the issue of 21st century skills. For example, The Partnership for 21st Century Skills (P21), a U.S. advocacy organization formed in 2002, has developed a vision of the broader set of skills required for success in the 21st century. These include core skills covered by the existing curriculum in most countries—language, mathematics, science, and arts—combined with 21st century themes such as environmental awareness and the impacts of globalization. These are complemented by learning and innovation skills, information media and technology skills, and life and career skills.[28]

It is possible to build on the P21 framework and argue that each student should have the capacity for the following:

· Problem solving and decision making

· Creative and critical thinking

· Collaboration, communication, and negotiation

· Intellectual curiosity and the ability to find, select, structure, and evaluate information

And the motivation to be:

· An independent self-starter who is responsible, persevering, self-regulating, reflective, self-evaluating, and self-correcting

· A lifelong learner who is flexible and able to adapt to change

It is also likely that success in the global workplace will require 21st century education systems that increase performance in the STEM (Science, Technology, Engineering, and Mathematics) disciplines. STEM skills are increasingly sought out by employers globally as a key source of innovation and growth. At the same time, there will still be a need for learning opportunities in vital areas such as the humanities and the arts, and specializations that enable students to pursue their interests and strengths and thereby advance their competitiveness and potential.

Many 21st century skills are already supported by curricula around the world. For example, the U.K. science curriculum is designed to enable students to develop a number of skills such as teamwork, creative problem solving, and ICT literacy. Having elements of the 21st century learning agenda in the curriculum, however, does not necessarily mean they are widespread in the classroom. School leaders must translate theory into practice. Some critics argue that there is not enough time to teach these new skills and incorporate new forms of pedagogy. However, while some innovation in pedagogy may be needed, 21st century skills do not require an extended timetable since they can be transferred to learners within core subjects. How we teach, in this regard, becomes what we teach

21st century pedagogy

In their detailed study on how people learn, Bransford et al. explain that, "In the most general sense, the contemporary view of learning is that people construct new knowledge and understandings based on what they already know and believe."[29] In practice, this means that teachers must know their students well and build on existing knowledge and abilities. More specifically, a greater range of teaching styles is required to ensure that each and every child receives the attention and support needed to acquire deeper levels of knowledge and understanding, and develop a broader array of skills. As teachers add to their repertoire of teaching techniques, they are better positioned to adopt different strategies to ensure that each student's personal learning needs can be met.

As policymakers turn to instructional approaches that reflect a "constructivist" understanding of how students learn, it becomes increasingly clear that pedagogy for the 21st century will comprise four main interwoven parts:

- **The learner at the center:** This approach caters to multiple learning styles and adapts education to reflect the learning needs of each individual. In the United Kingdom, for example, every school child will be assessed and receive tailored and dedicated support for attaining performance goals within this model.[30]

- **The teacher draws from a repertoire of strategies and skills:** Good teachers have always listened as well as lectured, but now this skill is more vital than ever. While traditional education systems fostered the obedience demanded of the manufacturing workforce, the Education 3.0 system must nurture creative and collaborative skills. Knowledge is available at the click of a mouse, but learning to apply it requires a teacher who can instruct, facilitate, guide, and support as needed.

- **Interdisciplinary and project-based work:** Project work in complex areas, such as robotics or environmental change, can help students learn how to draw on multiple disciplines and recognize the interdependence of various systems. Interdisciplinary and project-based teaching is also particularly conducive to working in teams, and hence provides another example of the link between 21st century skills and the pedagogy used to impart them.

- **Authenticity:** Delivering learning that is authentic is another way to engage students by appealing to their existing passions and interests. It is equally important to integrate real-life experiences into lessons: students do not just make an architectural drawing, they actually build a structure on the school lawn. This also provides the opportunity for learning that extends beyond the classroom into the community, the wilderness, the workplace, and the virtual world.

There is already abundant good practice that embodies the key components of 21st Century pedagogy. Sometimes this makes use of technology but very often it does not. The following examples illustrate how technology can help improve student engagement and learning outcomes through enhanced teaching methods:

- Cognitive Acceleration through Science Education (CASE) is an intervention strategy that combines curricular tasks and teaching methodology. The tasks are designed to challenge students' concepts of science by presenting them with problems they are unable to solve using their current mental strategies. Students work in small groups to develop ideas and then share them with the class. The teacher has continual opportunities to challenge the students' ideas and concepts and thereby stimulate learning. Longitudinal studies have found that CASE students achieve significantly higher grades than other students, not only in science but also in mathematics and language.[31]

- The Mathematics Laboratory developed by the Central Board of Secondary Education in India uses activity-based learning to help students develop a greater understanding of mathematical concepts. Hands-on experience in a laboratory setting contributes to more exciting and interesting processes of discovery at more than 9000 schools involved in this project. Initial feedback has highlighted the importance of providing teachers with appropriate orientation programs to help them integrate the approach into their teaching practices.

- Students from the Bronx in New York City used classroom technology and online resources offered by the U.S. National Archives in Washington, DC to create a comprehensive archive of their town's history. The students conducted research to identify and catalogue important historical events. They collected photos and artifacts, conducted interviews with people who knew the town's history, and even visited graveyards to piece together the family trees of notable citizens. All research was compiled and made available through the local chamber of commerce.

- English as a Second Language (ESL) students in a poor, urban U.S. neighborhood learned to create poetry that reflected their personal concerns by participating in a poetry slam contest. Since the students were not fluent in written English, their teacher interviewed them about their passions and problems. Each student used the interview as a foundation for writing a poem. On the day of the competition, the students performed their poetry through a live broadcast that was viewed by competitors at other schools and a panel of professional poets. This learning event built the students' confidence in writing, performing, and expressing their thoughts while providing an authentic forum for their work.

Technology

People increasingly rely on digital information in the workplace, in commerce, during leisure activities, or at home. However, the experience of teaching and learning has been relatively less affected by technology.

This is not to say that schools, colleges, and universities have not advanced technologically since the 1980s and 1990s. On the contrary, technology has led to significant improvements in the efficiency of school administrative processes such as scheduling classes, managing budgets, tracking students, and monitoring security, which have all been automated and immeasurably strengthened; though there is often more to be done.

Even if technology has not changed teaching and learning to the extent that it could and should, it has certainly facilitated improved practices by bringing better teachers to more students, creating virtual communities of teachers and learners, and providing real-time assessment. The following examples help illustrate the impact of technology on learning:

- The Institute for Strategy and Competitiveness at Harvard Business School offers a course on the Microeconomics of Competitiveness, taught by Michael Porter and delivered to students at universities around the world. The course involves case studies and other written materials plus video lectures featuring Professor Porter, government officials, and other senior speakers. One Website helps faculty prepare and teach the course, while another can be customized for students at each participating university. The program is currently facilitated by teachers at more than 50 universities around the world, many of which are in developing countries. This effectively gives students access to one of the top strategic thinkers in the world.[32]

- Curriki, an online community for teachers, had 35,000 members and 3000 educational assets online within six months. Content includes integrated, interdisciplinary mathematics, science, and writing units, as well as interactive demonstrations such as the mathematics of flocking behavior in birds.[33]

- In Oak Grove Middle School, Mississippi a teacher has been using real-time "voting clickers" to gauge comprehension while she teaches. The students use the clickers to answer questions during class and the teacher can see how many students answered each question correctly. This allows for real-time adjustments and interventions.

Although these innovations are making a real difference, they are scarcely transformative of teaching and learning, and represent only a modest return on technology's potential. Within reach is the capacity for young people to complement their online social destinations—MySpace, Facebook, and Second Life—with a personalized learning space. Here they could amass a wealth of education resources in rich multimedia format, gain access to world experts in multiple disciplines, enjoy authentic learning using online data, receive instant feedback from teammates and teachers on their ideas and their performance, and interact with students from all over the world as they collaborate on group projects. This is not some futuristic prospect. It is already possible for students in metropolitan Mumbai, for instance, to work with students in a village in Rajasthan, or for students in North America to work with students in the Middle East. It is also the approach to work that many employers increasingly encourage in their employees.

The same technologies that have spurred the development of the Internet as a tool for creating and sharing knowledge could now help learners build critical 21st century skills, supported by the key elements of 21st century pedagogy, as shown in Exhibit 8. In addition, these technologies could respond to the concerns and aspirations of parents, teachers, and learners by providing:

- Safe online environments, owned and populated by each educational institution

- A window for parents to monitor their children's development and performance and communicate with teachers in much greater detail

- The ability for teachers to be "present" throughout a learning journey; providing personalized feedback and coaching students
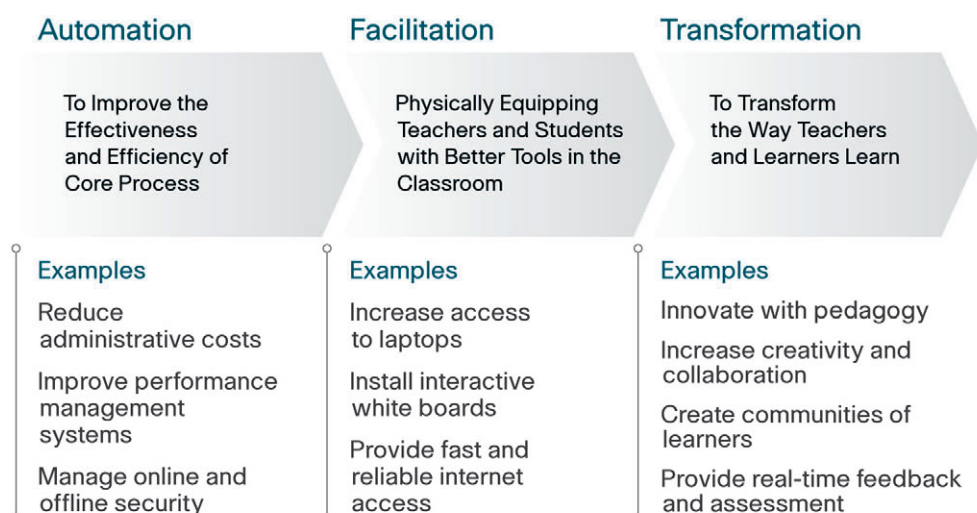
Automation	Facilitation	Transformation
To Improve the Effectiveness and Efficiency of Core Process	Physically Equipping Teachers and Students with Better Tools in the Classroom	To Transform the Way Teachers and Learners Learn
Examples	**Examples**	**Examples**
Reduce administrative costs	Increase access to laptops	Innovate with pedagogy
Improve performance management systems	Install interactive white boards	Increase creativity and collaboration
Manage online and offline security	Provide fast and reliable internet access	Create communities of learners
		Provide real-time feedback and assessment

Source: Team Analysis

Exhibit 8:

Evolution of technology in education

While Cisco, as a high-tech company, is passionate about the role digital technology can play in society, we recognize that many teachers regard it as a double-edged sword. On the one hand, it has helped schools and colleges bring down costs, improve performance management, and increase security. It has also extended access to learning opportunities around the world. In China, for example, e-learning is growing at 23 percent a year, and distance education now accounts for up to 15 percent of all higher education globally, including 30 percent in Russia.[34] There is also a concerted effort to bridge the digital divide through affordable laptop programs. On the other hand, technology has arguably failed to live up to the potential claimed for it a decade ago.[35] To date, there is no definitive correlation between increased investments in ICT and better test results.[36] In fact, research in this area is decidedly mixed, with a recent report to the U.S. Congress finding no improvement over traditional methods when students were taught with e-based mathematics software.[37] It is important to note that when technology does not produce improvements in student outcomes, it is often because the necessary conditions for the effective integration of technology, such as a school-wide strategy for teaching and learning and teachers trained in its use, have not been met.

Despite these challenges, examples of excellence throughout this paper suggest that the emergence of the new technologies, designed around the principles of creativity and collaboration, are central to both 21st century pedagogies and 21st century skills. Nevertheless, technological failures indicate that setting forth a new vision is not enough to positively influence the experience of learners. For that, three significant barriers will need to be overcome. The best designed technology-curriculum integration plan embodies the interests of the students as well as the requirements of the educational systems.

The first is access. Broadband access is an essential precondition for the effective use of collaborative technologies in teaching and learning. Although most developed countries have set ambitious broadband targets for their schools, few have fully reached them. In emerging countries such as China and India, some rural areas are now implementing kiosk-based broadband education services. However, broadband access is neither widely available nor affordable for most citizens. Elsewhere, including much of Africa and parts of the Middle East, broadband networks remain out of reach. Low-cost relay experiments, often supported by international bodies such as the UN and the World Bank, support progress in this area, but need to be accelerated.

The second barrier is traditional methods of training and development for teachers and administrators. Teachers will need a clear understanding of the educational benefits of new technologies and the most productive and creative ways to integrate digital resources into the curriculum. The growing availability of open source resources, which often incorporate attractive media assets for educational use and adaptation, may convince teachers that the time has come to make the shift. Leaders will need to manage technology investments carefully; considering total cost of ownership. This means allocating funds to cover equipment costs as well as time and resources to help teachers develop the skills and capabilities needed to deploy these tools in support of teaching and learning. In Singapore, for example, the Ministry of Education is engaged in a series of projects to focus the attention of educators on the need for a comprehensive and integrated approach to the introduction of technology.

The final barrier is design. What often seems to underpin the failure of technology in education is poor alignment between learners and the everyday practices of teachers, lecturers, and system leaders. Ultimately, technology needs to meet the unique objectives and capabilities of each education system or institution; or, as the third Hong Kong IT Education Plan describes it, provide the "right technology at the right time for the right task." Just as businesses must deploy technology in a way that supports sound business practices, educators must deploy technology in a way that addresses fundamental education objectives and encourages the active participation of each learner in the learning process.[39]

21st Century System Leadership

The transformation of skills, pedagogy, and technology use cannot take place without a new approach to system reform.

It is often said that if someone from the 19th century were to travel forward in time, he or she would find a revolutionary change in nearly every dimension of society, with the exception of the classroom; with a teacher at the front, writing on a board, and pupils in rows of desks taking notes. Our education systems continue to reinforce traditional approaches to teaching. Changing this will require leaders to develop a compelling vision of 21st century learning, communicate it with passion, and ensure that it is translated into action at all levels of the system. The transformation will need to be holistic; from government ministries to principals and classroom teachers. It will also require a holistic reform of education delivery, to align incentives and provide resources for teacher training, curriculum development, accountability, and assessment. The Education 2.0 pillars of system reform will need to be adapted significantly for Education 3.0:

- **Teachers:** Great teaching is at the heart of successful learning. Great 21st century teachers will weave 21st century skills into core subjects through new pedagogy, enlivened by collaborative technologies. New and proven instructional approaches and digital resources will become a core toolkit for 21st century teachers. This transformation will require new forms of teacher training and professional development.

- **Curriculum and assessment:** In the future, curricular reform will most likely be required to balance core subjects and new 21st century skills. This will also require fresh thinking about performance measures to overcome legitimate concerns that there has been limited progress toward recognizing and rewarding skill development that cannot be detected in an end-of-term assessment.

- **Accountability for outcomes:** Accountability will be more essential than ever in 21st century education systems. School leaders will be accountable to students; questioning if school is staying relevant to their lives. Policy leaders will be accountable to employers and citizens; questioning if the system is effectively preparing young people to help meet national aspirations. It will also be important to measure accurately the impact of new skills and pedagogy in the classroom to bring about new and improved outcomes.

These reforms will be regarded by many as too bold; but for learners and employers they are changes that should have already occurred. The difficulty of changing education systems cannot be underestimated, but the imperative for change is hard to ignore.

The Vision

A Global Destination with Local Journeys

This white paper has set forth a vision for 21st century learning that prepares students for a highly connected and interdependent world. We believe that 21st century learning is a global destination that applies as much to a village in India or Uganda as it does to modern cities such as Shanghai, Tokyo, and New York. However, reaching this destination will clearly require a local journey, guided by an understanding of local traditions and circumstances, and drawing heavily on proven strategies and practices.

Our conversations with system leaders everywhere are helping us advance our thinking. We have learned for example that:

- **21st century pedagogy can increase engagement:** Learner-centric teaching, active facilitation, and authentic, hands-on activities can lead to higher levels of student participation and engagement, which are prerequisites for better outcomes in the long term.

- **Technology can make a real difference, but it must be deployed thoughtfully:** System leaders need access to professional guidance as well as education technologists who can help them apply new technologies to learning. Long-term planning must focus on the total cost of ownership of technology, and strike the right balance between hardware, software, connectivity, and content.

- **Teaching the teachers is critical:** The development of front-line capabilities needs to extend far beyond a single ICT training course. Many teachers are intimidated by new approaches and unconvinced of their value, but after buying into the overall objectives and receiving support from their peers, they often overcome these hurdles and became passionate advocates.

- **Achieving system-wide transformation requires the alignment of all key stakeholders:** From His Majesty King Abdullah II of Jordan to the parents of students in Mississippi, a broad coalition is needed to achieve lasting reform.

Next steps: a dialogue

Many national leaders have achieved far reaching change in their educational systems, but none so far has achieved 21st century goals as proposed in this document on Education 3.0. Few, if any, are prepared both to adopt a radically different education policy and to pull all the necessary change levers at the same time or in close succession.

Cisco recently created the Global Education Group. This group is working with education teams across the company, and building on their successes and lessons learned to offer an expanded perspective on education around the world and help education system leaders analyze and address the profound challenges that face them in supporting and shaping the global knowledge economy.

A first step is the publication of this paper. The ideas presented here draw on our experience and insights, but our thinking has been developed, refined, and immeasurably improved by experts in the United Kingdom, Australia, China, India, Hong Kong, Singapore, and Korea.

Even so, this paper is only one contribution to the flood of new thinking that is coursing through education systems in every part of the world. Our next step, therefore, is to propose a dialogue in which new ideas can be critically examined and discussed. Over the next few months, we plan to facilitate a conversation among opinion leaders, educators, and politicians from developed and developing nations. Our aim is collectively to refine a vision for 21st century learning, and to gather the best and most powerful insights into how that vision can be realized.

We have planned a number of events globally to engage a broad range of practitioners, policy makers, and thinkers in this discussion. We have also created a Website that we hope will be a shared space for people to meet, talk, and collaborate in shaping new ideas. You can visit the site at: www.transformglobaleducation.org.

Thank you for reading Equipping Every Learner for the 21st Century. We look forward to hearing your thoughts.

— **Michael Stevenson,**
 Vice President, Global Education
 Cisco Systems, Inc.

End Notes

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