21st Century Learning Environments

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21st CENTURY LEARNING ENVIRONMENTS

INTRODUCTION

This white paper has been created to provide an overview of research and expert opinion on 21st century learning environments, one of the four support systems in the Partnership's 21st Century Skills Framework. Its purpose is to offer a descriptive view of the places, tools, people, and policies that make up 21st century learning environments and, we hope, inspire its readers to work towards their realization. To further guide schools and communities in designing dynamic 21st learning environments, the Partnership's Resource 21 site provides a wealth of information on this and other Framework elements at http://www.21stcenturyskills.org/route21/.

What is a 21st century learning environment?

The term "learning environment" suggests place and space – a school, a classroom, a library. And indeed, much 21st century learning takes place in physical locations like these. But in today's interconnected and technology-driven world, a learning environment can be virtual, online, remote; in other words, it doesn't have to be a place at all. Perhaps a better way to think of 21st century learning environments is as the support systems that organize the condition in which humans learn best – systems that accommodate the unique learning needs of every learner and support the positive human relationships needed for effective learning. Learning environments are the structures, tools, and communities that inspire students and educators to attain the knowledge and skills the 21st century demands of us all.

Experts say 21st century learning must take place in contexts that "promote interaction and a sense of community [that] enable formal and informal learning."[i] Thus, this paper will address the relationship of physical spaces and technological systems to learning, but more importantly, it will also consider how those resources support the positive *human relationships* that matter most to learning. And while technology, space, time, culture, and policy will be discussed separately, it is important to remember that their power is cumulative.

Real learning effectiveness occurs when these systems are artfully integrated into a seamless whole in which each system reinforces the others.

It is worth emphasizing, too, that these support systems are valuable not as ends, but as means to a greater goal – to helping children grow emotionally, socially, physically, and academically. Academic achievement, as research from the Association for Supervision and Curriculum Development (ASCD) shows, is inextricably intertwined with social, emotional, and physical health.[ii] Thus, 21st century learning environments address the multiple and interconnected learning needs of the whole child.

Whole environments for the whole child
The age-old connection between strong minds and strong bodies has always made good sense, but we now have the educational research to back it up. If we want our children to have sound and agile minds, we need to help them achieve sound and agile bodies. To educate the whole child, though, schools must devote themselves to more than the mind-body connection alone. They must attend to the emotional and social learning needs of children, as well as to more traditional objectives of academic achievement and physical education.

While the roots of the whole child movement date back to the child-centered philosophies of John Dewey, current educational research and a new broader conception of student achievement add even greater significance and urgency to its appeal. The ASCD, a Partnership for 21st Century Skills member, has joined with over 30 leading education, health, arts, and civic organizations to establish the Whole Child initiative which encourages schools and communities to work together to create learning environments that enable children to be healthy, safe, engaged, supported, and challenged.[iii]

The Partnership's 21st Century Skills Framework reflects the same spirit as the Whole Child goals. The Framework outlines the multiple student outcomes that modern life demands, as well as the support systems that will enable the realization of these outcomes. At first glance, a 21st century learning environment may appear to be one of several support systems in the Framework, but in fact, it is itself an integrated system of multiple supports. Thus, the Partnership views a

21st century learning environment as an aligned and synergistic *system of systems* that:

- Creates learning practices, human support and physical environments that will support the teaching and learning of 21st century skill outcomes
- Supports professional learning communities that enable educators to collaborate, share best practices, and integrate 21st century skills into classroom practice
- Enables students to learn in relevant, real world 21st century contexts (e.g., through project-based or other applied work)
- Allows equitable access to quality learning tools, technologies, and resources
- Provides 21st century architectural and interior designs for group, team, and individual learning.
- Supports expanded community and international involvement in learning, both face-to-face and online

Such an environment fosters learning tailored to the needs and wants of the individual. This sort of learning occurs anytime and anyplace, when and where the learner desires. It takes place in a context of relevance, "just in time," rather than "just in case." And such learning offers "just what I need" – that is, the opportunity to acquire knowledge and skills through learning strategies that are personalized and adapted to the learner's own learning styles and preferences. To guide policymakers, educational authorities, and school leaders, the Partnership has prepared this white paper to promote the vibrant educational environments – physical and online, technological and human – that support the 21st century learning all children deserve.

STRUCTURES FOR LEARNING

What physical and temporal structures best support the teaching and learning of 21st century skills?

Smart, Agile Schools

School design is a critical issue in most school districts these days. According to the American Architectural Foundation, "Each day across the United States, more than 59 million students, teachers, and education employees spend considerable time in our nation's 120,000 school buildings. Unfortunately, too many of these schools are aging, crowded, and in need of repair."[iv] Further, the AAF observes, "…with school enrollments growing "at record levels through 2013, and spending on school construction, renovation, and maintenance expected to total nearly $30 billion annually, the need to transform our schools has never been more urgent."[v]

Facing similar demands a century ago, school districts in the U.S. built thousands of schools that intentionally mimicked the industrial forms that had so sweepingly transformed the workplace. As historians Tyack and Cuban point out, this factory approach to schooling[vi] has been remarkably durable over time: children enter school at the same age, are sorted into age-based grade levels, exposed to standardized curricula and textbooks, assessed at fixed points, and expected to progress at the same rate as their peers. Even today, many school buildings can be hard to tell apart from the factories they were built to resemble.

Of course, many schools have advanced well beyond this outdated model. Most classrooms today are undeniably more flexible, more colorful, and more engaging than their 20th century counterparts. Students may no longer sit in rows of chairs bolted to the floor. Student work may be on display. Technology may be present, perhaps in the form of a whiteboard at the front of the room or a few computers in the back. In some schools, there may even be a laptop for every student.

But such classrooms are just the beginning. Much more needs to be in place for 21st century learning to truly thrive. But with tight budgets and worries over the economy, some may ask whether school design

really makes a difference. While the building alone does not make a 21st century school, common sense suggests that the qualities of *where* we learn affect the quality of *how* we learn. Georgetown University researchers, for instance, have found that improving a school's physical environment can increase test scores by up to 11%.[vii]

The Organisation for Economic Co-operation and Development (OECD) has considered learning needs around the globe in recommending that schools "accommodate both the known and identifiable needs of today, and the uncertain demands of the future. They should provide an environment that will support and enhance the learning process, encourage innovation, foster positive human relationships--in short, be 'a tool for learning.'"[viii] So what does such an environment look like?

For one thing, 21st century learning spaces will not all look alike. The industrial era's cookie-cutter approach to school design does not map well to today's multifaceted educational needs. Instead, schools and other places of learning must to reflect our understanding of how people learn. In a recent AAF white paper, former principal Elizabeth Lodal notes that today's students "…need to be inspired to become creative problem solvers and intellectual risk takers so that they are prepared for the world of the 21st century. School design will either inhibit or support and enhance such a robust education program."[ix] And while every school will reflect the unique needs of its community, there are sound design principles to guide the creation of learning environments that truly promote kind of education on which 21st century students will thrive.

Designs for Learning
Perhaps the most fundamental guideline is "design for flexibility." Since no one can predict how educational technologies and teaching modalities will evolve, learning spaces must adapt to whatever changes the future may hold. To achieve this flexibility, architects are designing classrooms, or "learning studios," with moveable furniture and walls that can easily be reconfigured for different class sizes and subjects.[x] The school building itself should inspire intellectual curiosity and promote social interactions. DesignShare, an organization devoted to sharing best practices and innovation in schools,[xi] sponsors an annual awards program to recognize outstanding school design across the world.

The three DesignShare 2007 winners all look and feel very different, as one would expect given their very different student bodies and instructional missions. A nursery school in Japan features a huge indoor activity space that emphasizes unstructured play. An alternative learning center in Alaska, created from an old movie theatre, incorporates elements of that state's unique cultural heritage and focuses on self-directed learning. A Denver charter school, aimed at increasing the participation of low income and female students in technology, integrates high tech design with "soft touch" furniture and moveable walls that promote the sensory experience of learning.

Inherent in these and other 21st century designs is the notion of buildings that flex to accommodate the human relationships that are critical to successful learning. As a leading school architect has noted, schools must "create an environment where the kids know each other and know their instructors, not just academically but as people." School designs that convey friendliness, openness, and accessibility promote cooperation and interaction, and reduce the tensions that can lead to inattentiveness, acting up, and bullying. What goes for kids, goes for adults, too. Educators need tools and spaces that enable collaborative planning and information sharing.[xii]

Fig.1: A 21st century classroom design
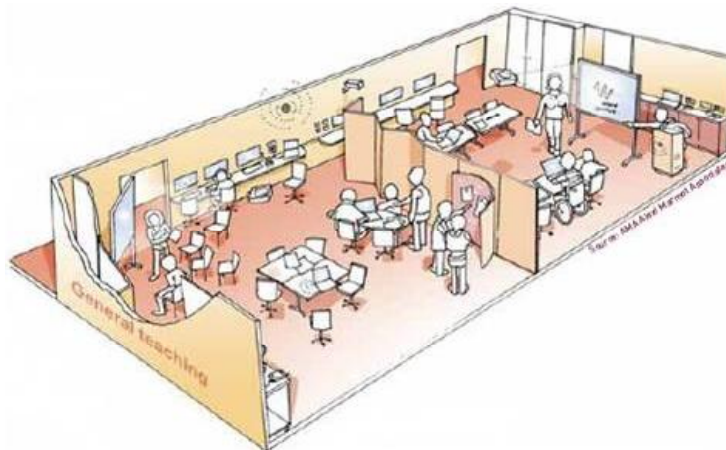
Source: © AMA Alexi Marmot Associates

Connecting with the Wider World

Over a century ago John Dewey, the noted American philosopher and educator, observed that learning that endures is "got through life itself." While the physical space of many 21st century learning environments may be small, the learning they engender extends out into the local community and the world at large. Students and community members may work together on service projects and internships. Learners may connect with their peers across the globe to share data on a common problem like climate change or wildlife preservation. Teachers and students may seek the advice of world-renowned experts to guide them in their inquiry-based projects. Technology obviously enables such connections, but physical structure, too, can play an important role in facilitating these essential 21st century learning experiences.

According to the American Architectural Foundation, one way to do this is through innovative sharing of space with the school's local community, such as making performance spaces and meeting rooms available to the general public.[xiii] Some communities are establishing pre-school daycare or senior centers within school facilities and developing programs that bring students together in meaningful ways with those much younger or older than they. Such an effort can include scheduling classes at different times (not just between the hours of 8 and 3), as well as going beyond to include homework support and mentoring, intergenerational gatherings, and more. Schools must become community centers with hours that extend well beyond the current school day to provide access to technology resources, recreational activities, and health services.[xiv] Such collaborative arrangements can offset costs for all stakeholders while creating year-round multi-generational learning places that enrich relationships among community members.

Architects and school planners strongly suggest that educators seek input from the community when designing a new school or undertaking a major renovation of an existing structure.[xv] Having an effective process for gathering and reflecting on public opinions and needs will result in greater buy-in for the plan, and, ultimately, greater support for the resulting buildings. Students, too, are critical

participants in the process. As the ultimate consumers, their opinions about their learning space matter greatly, of course. Further, students find that getting involved in building design provides them with a rich real-world learning experience.

The American Architectural Foundation has tapped into the creative capacity of young people by asking them to design their own learning environments. The AAF and Target stores annually sponsor the *Redesign Your School* contest, the U.S.' largest design competition for high school students.[xvi] The contest generates innovative ideas for 21st century learning spaces while encouraging collaboration and innovation among students, educators, parents, designers, and the media.

Sustainability and Re-use
For schools these days, as with any construction project, the watchword is sustainability. While going green may once have been felt to be a luxury, it is now seen as a common-sense strategy. School officials see value in investing in slightly higher construction expenses to realize lower operating costs over the lifespan of the building. To help educational authorities sort out their options, experts advise them to focus on green design elements – like air quality, temperature control, and lighting – that have a proven positive effect on learning, and pay for themselves through long-term resource efficiency.[xvii]

A 2006 report, *Greening America's Schools: Costs and Benefits*, reviewed 30 U.S. schools designed for sustainability and found that they cost less than 2% more than conventional schools – or about $3 more per square foot – to build, but provide long-term financial benefits that are 20 times as large. Furthermore, the report notes, "for an average conventional school, building green would save enough money to pay for an additional full-time teacher. Financial savings to the broader community are significantly larger, and include reduced cost of public infrastructure, lower air and water pollution, and a better educated and compensated workforce."[xviii]

Green schools also provide rich opportunities for students to explore sustainable planning and design, and learn about the impact that design and operations decisions have on the environment. Sustainable schools also serve as positive examples to students, educators, and

community members, encouraging everyone to "think green" in all areas of their lives.[xix] A wonderful example is found at St. Pancras Primary School in southern England, where students have turned the building of a new environmentally sustainable addition into an opportunity to learn 21st century skills. By documenting the planning and construction process, students are deepening their understanding of environmental issues, while gaining IT and video production expertise and honing their narrative skills by documenting their compelling story. [xx]

But in many communities building from scratch is not an option. What can be done about school buildings that already exist? Many urban districts are finding that renovation of older buildings can be an attractive and environmentally sensitive option to building anew.[xxi] Historic school buildings often make effective use of natural resources like light and ventilation simply because modern energy-consuming options like air conditioning were not available at the time of construction. Successful renovations can also revitalize the surrounding neighborhoods, providing a focal point for community life, while leveraging strategic locations and existing public transportation options.

Re-conceiving the Library
Twenty-first century design is also influencing another traditional learning space – the school library. As more and more content moves into virtual form, many schools are wondering how the library should respond. Yet even as information becomes digital, kids still need space, says Julie Walker, the executive director of the American Association of School Librarians (AASL). The library media center should be the nerve center of the school, a place where kids gather to get *and* create information, a place where they can get excited about learning *and* where they can escape from the pressures of the day.

The 21st century library media center must play multiple roles: carrying out its traditional role of bringing information resources to learners, of course, but also providing the tools and infrastructure that enable learners to analyze, synthesize, and evaluate resources in ways that demonstrate learning and create new knowledge. It must offer places for formal learning in which large groups can gather for presentations; places for social learning where teams can collaborate on projects; and places for individual learning where individuals can

find a quiet space for reading, reflection, or relaxation. These centers must also connect kids and adults to the wider world beyond the school by providing the audio and video communications technologies that build bridges between people and places all over the globe.

As the AASL puts it, "The physical space serves as an intellectual gymnasium with multiple, flexible spaces that accommodate a variety of learning tasks."[xxii] A 21st library is more than just a physical place, of course: it also has a virtual aspect. Many school libraries are creating portals that link their holdings to other appropriate sites and afford 24/7 access to information for their school community. For a superb example, see the rich array of reading and information literacy links, wikis, tools, and courses for students and teachers at Springfield Township High School at http://www.sdst.org/shs/library/.

Some school media centers are borrowing an idea pioneered in higher education and transforming themselves into "learning commons" – hubs that support learners by providing library resources, IT tools and support, tutoring, and other academic support services, all in one central location. These new spaces show the promise of the 21st century school library – as a gateway to information resources and services, a design studio to spur creativity and collaboration, and a calm and orderly place to make sense of a data-flooded world.

TIME FOR LEARNING

Flexibility of design needs to extend to time as well. Twenty-first century learning cannot fully flower when embedded in a rigid 19th century calendar. More malleable units of time than the typical 50-minute class period are required for project-based work or interdisciplinary themes. Many schools are turning to block scheduling to create bigger, more adjustable time slots for student learning, and for teaching planning and professional development.

But these are just the first steps in taking a 21st century approach to time. Schools must also move away from the antiquated notion of "seat time" – that is, measuring academic accomplishment by the amount of time spent *on* the topic, rather than a demonstration of *what* was learned. One marker whose time is up is the Carnegie unit, used by high schools calculate how much time students should spend on a given subject. In 2006, the ASCD's High School Reform Proposal noted that schools are currently "hindered by inflexible graduation, time and attendance requirements, such as the 100-year-old Carnegie unit, that do not reflect contemporary knowledge of best practices."[xxiii]

Eliminating time-based measures of academic achievement means that assessment practices must change, too. Two states are leading the way. New Hampshire, the first state to eliminate the Carnegie unit requirement, will instead assess student achievement through demonstrations of subject matter mastery and application. Rhode Island now uses the term 'Carnegie unit' to refer to courses that are evaluated on competence measures rather than seat time. Both states are linking these new measures of time with new 21st century assessment policies that "emphasize real-world learning and allow students to pursue alternative approaches outside the classroom to acquire knowledge and skills." [xxiv]

Establishing time during the day for collaboration and planning is another way to advance 21st century teaching practice. In earlier eras, teachers had little structured time during the day for interaction with other adults. Today, though, the challenges of preparing all students for success require the collaborative efforts of all the professionals in a school. To ensure that this time is used productively, school leaders at Upper Merion Area Middle School in Pennsylvania have developed a

comprehensive planning guide that helps teachers move from collegial conversations to critical dialogue. According to Assistant Principal Jabari Whitehead, the guidelines, based on principles of action research and Malcolm Baldrige's 'Plan, Do, Study, Act' model, enable teachers to use data to drive decision making as well as develop appropriate interventions.[xxv]

Other states and districts are experimenting with extended school days and school calendars to provide more opportunities for learning and more durable linkages between students, families, and the community. But merely lengthening the school day or school year does not guarantee the desired results. Professor Lawrence Baines has pointed out that U.S. students attend school on average over 1,100 hours per year, while students in most developed nations, most of whom outperform U.S. students on international tests, go to school an average of 701 hours per year.[xxvi]

This statistic suggests that relationship between time and learning is not a simple one. A 2007 Education Sector report acknowledged this fact, while noting that "improving the quality of instructional time is at least as important as increasing the quantity of time in school…" and observing that "the addition of high-quality teaching time is of particular benefit to certain groups of students, such as low-income students…" [xxvii]

Thus, it is not just *how much,* but *how* time is used that matters. According to a recent study on education and time sponsored by the Mott Foundation,[xxviii] too often school systems pay insufficient attention to the many ways that students learn outside of the classroom, "from forming cultural bonds to multi-tasking with technology tools." The report calls for more formal research on the relationship between learning and time, one of the most understudied aspects of schooling.

But what seems certain is that learning does not happen on the clock. What is needed is a seamless approach to integrating all the forms of learning that occur in a child's typical day. Powerful learning can happen outside of schools through internships, online learning, and community service. The ASCD High School Reform Proposal sums it up: "What counts is not the time spent in the school building, but the learning that the student masters." Twenty-first century learning

environments promote this integration of formal and informal learning, for "when it comes to learning, there is no final bell."[xxix]

TOOLS FOR LEARNING

What technological infrastructures best support the teaching and learning of 21st century skills?

Students today need access to the digital tools and media-rich resources that will help them explore, understand, and express themselves in the world they will inherit tomorrow. Educators need access to tools and resources to share knowledge and practice with other professionals, interact with experts in their field, and connect with their students' families and communities. Administrators need access to these same tools and resources to manage the complexities of the educational enterprise – from student records and performance data, to personnel management and facilities operations. A robust infrastructure, designed for flexibility and growth, can facilitate these connections – and more. The essential goal of technology, as it is with all systems for learning, is to support people's relationships to each other and their work. As in planning any complex task, infrastructure design must be approached with one eye on today's practical realities, and the other on tomorrow's opportunities.

A Seamless Interface
A 21st century learning environment blends physical and digital infrastructures to seamlessly support learning. Melding face-to-face with online learning is essential for schools today, but wise educators know achieving such a goal takes careful planning. All too often, school officials approach technology planning with trepidation. The choices can seem overwhelming, and mistakes can be costly. What can educational leaders do to avoid missteps?

Perhaps the greatest challenge of educational technology is not finding time and money to obtain hardware or software, or even in anticipating future needs, but in finding ways to *adequately support*

humans in using these tools. There is abundant evidence of the value of technology in promoting learning.[xxx] But putting technology in place is just the starting point; like any tool, its effectiveness depends on the user's skill in handling it, and on the conditions in which it is employed. Technology can only make a difference when students, teachers, and administrators are provided the necessary supports to effectively integrate it into their daily routines.

Finally, it bears repeating that technology planning must be approached systemically. Research shows that student learning gains are greatest when technology is fully integrated with "content, sound principles of learning, and high-quality teaching – all of which must be aligned with assessment and accountability."[xxxi] In other words, educational technology is most effective when it functions as part of thoughtfully orchestrated system that includes effective curriculum and instruction, ongoing professional development, authentic assessments, and a culture that embraces the learning potential of all its members.[xxxii] Technology has an additional synergistic benefit of supporting the other systems that make up a comprehensive 21st century learning environment.

Technology In Support of Learning
A number of professional associations provide valuable guidance on the many ways in which technology can enhance education. The Software & Information Industry Association recently released its *Vision K-20* website and report, which calls for every K-20 educational institution to fully embrace technology and e-learning by the end of the decade. [xxxiii] On the industry side, Cisco has commissioned a comprehensive literature review on the effectiveness of various educational technologies.[xxxiv] In 2008, the Consortium for School Networking (CoSN) launched *Empowering the 21st Century Superintendent,* a resource-rich website to help superintendents and other district leaders build their knowledge, skills, and confidence about educational technology.[xxxv] The International Society for Technology in Education (ISTE)[xxxvi] offers a wealth of resources on its website, including their award-winning Center for Applied Research in Educational Technology (CARET),[xxxvii] which features research-based resources that address critical educational technology questions.

As a first step in the technology planning process, policy makers and school officials should consider the technological options in light of the

needs and resources of their state, district, or school. Having a clearly articulated instructional strategy is essential for sorting through the possibilities and making informed decisions. As a CoSN brief reminds readers, "technology is not the end goal – it is but one component in an educational program."[xxxviii] It is how we use it that counts. Towards that end, what follows are some of the most notable ways that technology can enhance student learning and promote mastery of 21st century skills:

1. *Promoting greater student achievement:* According to a Cisco research review of seven major technology types, ranging from instructional TV to distance learning: "Overall, across all uses in all content areas, technology does provide a small, but significant, increase in learning when implemented with fidelity."[xxxix] To achieve positive results, educators are urged to seek out research-proven applications, and to pay close attention to aligning technology with leadership and staff development, teacher preparation, school culture, and curricular redesign.

2. *Increasing student engagement:* The Consortium for School Networking points out that "the allure of engrossing digital tools, entertaining experiences and social networking communities outside of school is making it increasingly difficult for educators to motivate and engage a large majority of students in academic learning with traditional pedagogy. Schools must create learning environments that are as engaging and relevant as the ones that students gravitate to outside of school."[xl] Research also shows that students are more engaged and more successful when they can connect what they are learning to situations they care about in their community and in the world.[xli] Technology provides access to real-world data, tools, and resources, and can help students link learning to life.

3. *Assessing student performance:* Many schools are recognizing the value of employing an assessment strategy that balances both summative and formative assessments. Technology can help with both types by providing educators with real time diagnostic information that deepens understanding of student learning gains and challenges.[xlii] Student performance tracking systems can enhance instructional decision making by helping

teachers pinpoint appropriate interventions. Such systems can result in significant improvement in student achievement, particularly in difficult subjects such as mathematics and English, while contributing to higher graduation and lower dropout rates.[xliii]

4. *Facilitating communication and collaboration:* Communications technologies provide pathways for the connections among students, parents, and educators that are at the heart of all strong learning communities. School management information systems and class websites support the home-school connections that are essential to children's academic success. E-learning and online professional development programs enable busy educators to learn anytime, anywhere, while fostering the exchange of ideas and best practice with peers. Online mentoring and coaching programs, too, afford educational professionals opportunities to learn from and with others in real-time, and asynchronous exchanges across town and across the globe.[xliv]

5. *Maximizing administrative effectiveness*: As the SIIA notes, infrastructure, data management, communication and systems diagnostic tools are critical to the success of any business enterprise.[xlv] School systems are increasingly using technology to manage the complex array of tasks for which they are responsible – including management of personnel, food and transportation services, supplies and instructional materials, security, and, of course, student information. In recent years, integrated student information systems (SIS) have offered state and district leaders the ability to manage a wealth of student, faculty, and operational data. Research shows that the benefits of an SIS include increased accountability at all levels of the system, greater access to instructional resources, and an empowered teaching force that uses data for self-reflection and instructional decision making.[xlvi]

6. *Building student proficiencies in 21st Century skills:* It is hard to find a 21st century skill that technology does not support. Applications that enhance thinking and innovation skills include access to the vast world of information on the Internet, electronic databases, simulations, educational games, design

programs, tools for creative expression, and many, many more. Life and career skills are honed by students' experiences with communication, presentation, and productivity technologies. And of course, information, communication, and media literacy – a vital 21st skill area – is founded on helping students make wise use of the many technologies that so shape modern life.

Students Supporting Technology
Networks and devices need maintenance to stay robust and current. Individuals need training and ongoing support to maximize technology's benefits. Yet, cash-strapped school systems are often unable to compete with the private sector for scarce technical support personnel. Creative school systems have turned this problem into a 21st century learning opportunity by establishing programs like MOUSE,[xlvii] that organize and train student-led squads to provide much of the technical support in their schools. Students learn valuable technical skills, while also honing other critical workforces skills like teamwork, project planning, and time management. Such programs have paid off in valuable corporate internships for their young participants, and even more importantly, in their enhanced self-confidence and capacity for leadership.

Guiding Principles for Technology Planning
Despite the fast pace which seems to be associated with everything technological, experts advise educators to *slow down* when making critical technology decisions. Leaders are encouraged to use those critical thinking skills: examine assumptions, gather data from many sources, envision alternative scenarios, then make an informed choice. In these days of tight resources and high expectations, technology planning must be approached intelligently.

Technology planners find it useful to adopt a *baseline strategy*. For many districts, it is not feasible to outfit its entire population with the latest digital technology. In such cases, it makes sense to first equip all classroom teachers with the 21st century tools they need for instructional and professional effectiveness. At minimum, every educator should have a laptop with high-bandwidth connectivity to the Internet, access to standard productivity tools, and academic and administrative applications appropriate to local needs. Each classroom should also have projector or whiteboard for in-class display of the teacher's laptop.[xlviii] The school library media center should, at

minimum, be able to support multiple simultaneous access to electronic resources as well as to a basic suite of tools for media production. As more resources become available, additional devices – such as laptops for students – can be deployed.

Schools in the 21st century do more than meet academic needs; they function like miniature cities, providing food, facilities, health, security, transportation, and recreation services for their students. Likewise, technology must do more than support than instruction. Powerful *enterprise management applications* can knit together the many functions of a school, and help make a complex organization coherent and efficient.

Organizational efficiency and educational effectiveness also depend on a *flexible telecommunications infrastructure* or backbone, with sufficient bandwidth to handle anticipated telephony, Internet, and local area traffic, plus overage to allow for future growth and new applications. To provide guidance, a recent SETDA report, "High-Speed Broadband Access for all Kids," describes desirable performance standards for both local and wide area networks.[xlix]

A Local Area Network (LAN) for a school or school district needs to cover all physical areas, including classrooms, the library, cafeteria, administrative, counseling, and special services offices. Thus, the LAN should cover instructional, transportation, food service, nursing, and ground and facilities personnel, as well as provide virtual areas for distance learning and remote access for educational purposes.

At the school or district level, the LAN should be designed to support the following (in order of deployment priority):
   1- Core network: routing and switching; network security; wireless access
   2- Building controls: physical security (video monitoring)
   3- Communications (audio, then video): telephony and its applications; videoconferencing; rich media on-demand; telepresence

The same SEDTA report calls on communities to provide 24/7 high-speed broadband access in order to create "rigorous, technology-infused learning environments" for students. In addition, such access enhances other 21st century learning support systems. Administrators

can conduct online assessments and retrieve data to facilitate decision making; teachers can tap into educational portals and curriculum-resource sites; and all learners can benefit when school, public, and academic libraries share electronic resources. With high-speed broadband, educators, students, and families can fully experience media-rich educational resources and participate in anytime/anywhere learning communities. The report notes that broadband access is especially critical in overcoming the digital divide in rural and low socio-economic areas.[l]

In addition to local area networks, states and countries need to consider deployment of a broadband network linking schools together with their central administration or ministry of education. It may also be advantageous to link such a broadband network to higher education institutions, thereby creating national research and education networks. Data centers, located on the broadband network and centrally running multiple academic and administrative applications, can enable economies of scale and lower servicing costs across a number of educational institutions, while facilitating research, scholarship, and learning at all levels.

COMMUNITIES FOR LEARNING

What types of relationships and communities nurture 21st century learning, and how can we create and sustain them?

From Isolation to Connection

So far, we have considered how buildings, schedules, and technology all contribute to 21st century learning. Now we come to the most essential of element of all: the "people network." This is the community of students, educators, parents, business and civic leaders, and policymakers that constitute the human resources of an educational system. The flexible spaces that enable productive learning and shared work/play opportunities, the creative uses of time that promote continuous learning, the extensible technologies that support collaboration among the school community and the outside

world – all these systems are valuable only in so far as they effectively support the human connections on which learning depends.

John Dewey long ago conceived of schools as "miniature communities"[li] that mirrored the social relations and activities of the larger society in which they were set. Yet, too often, schools have been silos of isolation – classrooms isolated from other classrooms, teachers isolated from other teachers, schools isolated from the outside world. Research shows, though, that positive and productive relationships within and outside an organization enable it to carry out its mission more effectively. When people are connected through technology and/or collaborative arrangements, their effect is multiplied, for communities "can accomplish goals that would be impossible through more isolated efforts."[lii]

Research shows that an educational community imbued with a *positive culture* is more likely to foster innovation and excellence. But what is school culture? According to the Change Leadership Group at Harvard, it is the "invisible but powerful meanings and mindsets"[liii] that shape the learning environment even more than the four walls of the classroom. What kind of culture is most effective? The answer is 'many.' There is no single culture that will fit all schools; each school must summon its own blend of teaching talents, instructional approaches, and effective leadership to meet the unique learning needs of its community.

One common element, though, unites all effective school communities: a commitment on the part of every member to the learning of *everyone*, children and adults alike. Leading educators such as Deborah Meier and Ronald Ferguson have shown that a *climate of respect and trust* among children and adults is essential to an effective and equitable school.[liv] Trust and respect also connote a commitment to the notion that every child deserves and wants to learn, and that every member of the school community is dedicated to every child's success – their whole success – as measured in their academic, social, emotional, and physical well-being.

A 21st century learning environment both gives and gets support from families and the local community. As Michael Fullan, a leading expert on school leadership, notes, "the research is very clear about the benefits, indeed, the necessity of parental involvement."[lv] There is

strong evidence, as well, that greater community and parental participation yields important educational advantages. The George Lucas Foundation cites numerous studies showing that strong home-school connections result in the following outcomes:

- Children do better in school when their parents are involved in their education
- After-school learning opportunities promote student achievement
- Community youth development programs spur academic performance
- Schools that integrate community services reduce risk and promote resilience in children[lvi]

Strategies for Healthy Communities

Accountability: Inside and Out
Today, we hear a lot about accountability in education. Generally, this is understood to be a system of external measurement – often accompanied by sanctions for non-performance – designed to ensure that a school system meets the expectations of external stakeholders like the general public, employers, or parents. Such accountability systems have their place in helping schools track the progress of the students in their care, and in enabling educators to monitor school progress, spurring them to greater achievement.

But there is another form of accountability that may be a more reliable source of organizational commitment and a more consistent wellspring of innovation. What leading educator Richard Elmore calls *internal accountability*[lvii] is fostered from inside the school organization, and stems from within each member of the community. Internal accountability occurs when professional conceptions of responsibility are aligned with deep personal values to forge a common vision. Successful schools, Elmore has found, conceive of accountability less as externally driven carrots and sticks, and more as an internally motivated sense of purpose and mission.

Internal accountability changes the view of "agency" or locus of control from a top-down rules-driven process to a decision-making framework that all community members understand and help shape. On the organizational level, this shift is analogous to what goes on at the instructional level as 21st century schools move away from the

teacher-directed learning associated with earlier eras to the student-focused learning of the 21st century. Today's 21st century learners view learning less as the imposition of rules and procedures from some outside source, and more as a self-directed process with increasingly greater levels of responsibility and commitment. Thus, accountability with within a 21st century educational system is understood to be an internally motivated and organizationally aligned sense of commitment to the student body, to the community, and to the education profession.

Professional Learning Communities
As the president of the National Commission for Teaching and America's Future, Tom Carroll writes, "Closing the education gap so that every child has an opportunity to successfully participate in a flat world is a demanding challenge. No teacher should be expected to do this job alone."[lviii] He and many other leading experts are advocates for learning teams in which school members collectively pursue professional knowledge and skills and take on shared responsibility for the success of all students. Learning teams, also known as professional learning communities or PLCs, engage in the reflective practice, collegial inquiry, collaborative work, and continuous innovation on which 21st century learning environments thrive.

One might assume that schools inherently are learning organizations, but as Gabrielle Martin-Kniep notes, they are often "…structured in a way that minimizes collaboration, reflection and innovation, the very elements that support meeting [21st century] demands."[lix] To break through, schools need to foster new forms of professional relationships that build organizational capacity and enhance personal growth. Research from noted researchers such as Linda Darling-Hammond[lx] and Eleanor Drago-Severson,[lxi] as well as leading associations such as the National Staff Development Council and National Commission for Teaching and America's Future, have found strong evidence that PLCs promote effective schools. These learning teams enable educators to refine their knowledge and skills in supportive ways and help overcome the isolation that has characterized teaching for too long.

Professional Partnerships
Mentoring, coaching, and long-term residencies are 21st century forms of teacher partnerships based on the age-old wisdom of

apprenticeship. To provide the guidance and support that new teachers need, the National Commission for Teaching and America's Future (NCTAF) recommends that schools establish cross-generational staffing programs – professional arrangements that pair experienced and novice educators with each other. New entrants gain valuable insights from lessons learned, while their seasoned partners are respected for their experience and reenergized by the connection to young talent.

Leadership for Learning

As educational organizations grow more diverse, they grow more complex. Good leadership is essential to organize this variety productively. Leadership expert Michael Fullan states, "Almost every single study of school effectiveness has shown both primary and secondary leadership to be a key factor."[lxii] A key role for 21st century leaders, according to Eleanor Drago-Severson, is establishing a culture of shared leadership, collegial relationships, and support for constructive change and diversity. Such a climate encourages the professional growth of educators, which in turn enhances student achievement.[lxiii] Successful school leaders are those who focus on student learning, provide support for professional communities, are "outward looking" (in seeking ideas and connections outside the school), and "demonstrate caring for the well-being and whole development of students and staff." [lxiv]

Not surprisingly, when it comes to learning, adults benefit from many of the same supports that children do, including access to up-to-date technology, and well-designed space and time for reflection, collaboration, and decision-making. Adults, too, benefit from school cultures that promote shared goals and accountability, productive interaction, and reliable measures of effectiveness. As Tom Carroll, NCTAF's director notes, in earlier eras, schools saw themselves as organizations focused on maximizing *teaching* effectiveness. In the 21st century, schools must be communities that maximize *learning* effectiveness.[lxv]

Community Partnerships

Educational partnerships within the extended community are essential in creating links to the arenas that the today's youth will occupy tomorrow – the domains of higher education institutions, the work place, various cultural spheres, and civic life. Schools and higher

education already work together in the area of teacher preparation and professional development, but many more opportunities exist to conduct joint research and collaborate on projects in service to their shared community.

Local businesses and community groups are traditional sources of after-school internships and summer jobs, but they can also be important sources of expertise in areas such as media, the arts, science, and technology. Of course, businesses and NGOs can provide resources – financial, physical, and human – to help school stretch their always-limited budgets. But the benefits to partnering go well beyond economics. Schools are home to the talent that will drive the local economy, populate tomorrow's workforce, and constitute the leadership of the future. Schools provide service opportunities that inspire and motivate local employees, and are highly visible venues for corporate social responsibility efforts. The greatest partnership benefit of all, though, may be the satisfaction of positively influencing the future. When businesses and civic groups come together with a shared vision for education, they create momentum that produces powerful outcomes for students, parents, schools, and the entire community.

POLICY IN SUPPORT OF LEARNING

How does policy support the development and sustainability of 21st century learning environments?

Policy emerges from a complex mingling of needs, opportunities, resources, personalities, and political will. In this context, policy merits special attention, as it – like a building, a leadership approach, or a computer network – is an organizing structure that promotes and sustains 21st century learning environments. Policy is the guidance system that regulates the activities, distributes the resources, and sets the priorities that determine, in large measure, the role of education within society.

Educational policy is never a simple matter, especially in the United States. Much policy originates at the state level, as states are chartered with providing public education. The federal role has been increasing in recent years, though, in particular since the passage of

the 2001 No Child Left Behind Act. Local policies abound as well, as district- and building-level officials determine how to implement state and federal policy. Because policymaking happens on multiple levels, local officials face the challenge of making sense of a host of rules, regulations, and standards that are not always well aligned, and at times, even conflict with one another.

Having a clear sense of overarching objectives can help with alignment. When policies are aimed at the same goals, conflicts among them are reduced. So, as in any planning process, the first step in creating good educational policy is articulating what education should accomplish. There is growing recognition among educators, civic leaders, business leaders, and the general public that today's youth will inherit a world that is far more dynamic and complex than it was even a few decades ago. The kind of education that prepared today's citizens will not serve the needs of tomorrow's.

Citizens of the 21st century need to think critically and creatively, embrace diversity and ambiguity, and create as well as consume information. They need to be resourceful and self-reliant, while also skilled at collaboration and group process. They need to understand the many "languages" of modernity – such as mathematics, science, and technology – and be fluent in varied forms of communication – such as persuasion, presentation, and self-expression.

Advances in telecommunications and digital technologies can enable much of this learning, but it is just as important for policy makers to build on recent gains in our understanding of human learning. Research shows, time and time again, that tools are only as effective as the tool users. So along with sophisticated architectures of physical sites and technology infrastructures must come support for human growth and development for the adults as well as children that these architectures support.

We must re-design schools that reach far beyond the traditional classrooms many adults experienced when they were young. The learning environments of the 21st century must encompass a rich mix of media and devices, varied cultures, and virtual and real-life relationships. Policy must serve as the steering mechanism to guide the creation of learning environments that are both more expansive and more inclusive – spaces for learning that offer more people more

access to more places and information while also allowing for close-knit social relationships among community members to flourish. Making all this happen is the task before us. It will not be easy, inexpensive, or quick. But it is essential.

Organizations, like individuals, need both supports and challenges to thrive and grow. Educational policy has usually done a better job with the latter that the former. For schools today, the challenges already amply exist in the many accountabilities and responsibilities they face. Policy can, and must, do more to balance the support side, because the quality of student learning in any setting depends greatly on the quality of learning among the adults who care for them. Educators must be given access to the knowledge and tools that support professional and organizational learning. They must also be offered time and space and tools to foster the collegial conversations that foster professional norms of equity and excellence. They need strong and effective leadership – at all levels of the organization. They must have opportunities to share expertise and best practice with peers inside and outside their community.

In Conclusion

Many schools today still reflect their Industrial Age origins with rigid schedules, inflexible facilities, and fixed boundaries between grades, disciplines, classrooms, and functional roles. The 21st century, though, requires a new conception of education – one that breaks through the silos that separated schools from the real world, educators from each other, and policymakers from the communities they meant to serve. The modern world demands learning environments that embrace the wide world of people, places, and ideas, and are flexible in their arrangements of space, time, technology, and people. These connections will foster healthy cultures of mutual respect and support among students, educators, families, and neighborhoods, serving their lifelong learning and recreational needs, and uniting learners around the world in addressing global challenges and opportunities.

In creating such learning spaces, we will have come closer to the vision John Dewey articulated over a century ago: "…to make each one of our schools an embryonic community life, active with the types of occupations that reflect the life of the larger society, and permeated throughout with the spirit of art, history, and science. When the school

introduces and trains each child of society into membership within such a little community, saturating him with spirit of service, and providing him with the instruments of effective self-direction, we shall have the deepest and best guarantee of a larger society which is worthy, lovely, and harmonious."[lxvi]

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