Learning

2.0

The Politics of Learning 2.0

From Governance to Capacity Building

Charles Taylor Kerchner

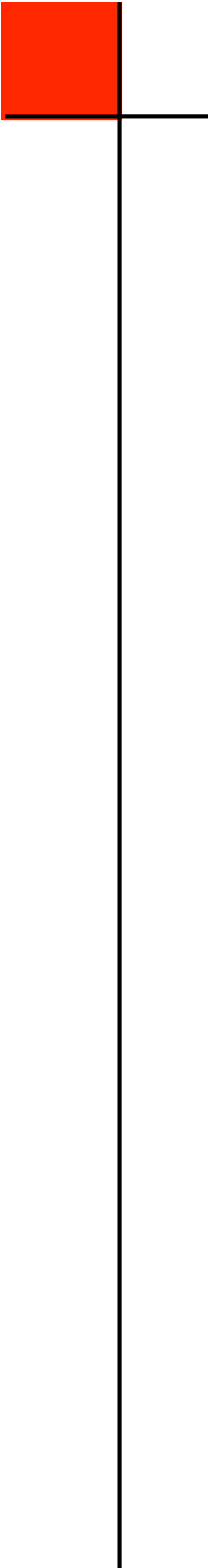January 2012

Claremont

GRADUATE UNIVERSITY

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Acknowledgements

Huffington Post for allowing me to be among their cast, John Fensterwald at *Thoughts on Public Education,* and David Plank and Corinne Arráez at Policy Analysis for California Education for publishing bits of this project as they tumbled from my keyboard.

The entire corpus, more than 30 individual posts, essays and case studies are available on the Mindworkers site. All are published under a Creative Commons copyright that allows free non-commercial use.

One of the rewards of electronic publication was immediate feedback, not all of it congratulatory, which helped the final product and allowed me to see the utility of the work. I was at a large education forum in Los Angeles when a reform-minded school administrator approached me. He said that he had read my latest post and had assigned it for a university class he was teaching. They would be discussing it that evening. The day was Thursday. My report had been written on Tuesday; the time from thought to application had shrunk to 48 hours.

The other reward was a return to journalism or at least semi-journalism. Before I became an academic I was one of the Usual Suspects at *The St. Petersburg Times,* a marvelous newspaper led by the most visionary editor-publisher in America, Nelson Poynter, whose memory deserves continuing honor and thanks.

Finally, to Leanne Bauman Kerchner. No one ever had a better friend and wife. You still make me laugh.

CTK

January 18, 2012

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Executive Summary: The Politics of Learning 2.0: From Governance to Capacity Building

The research that preceded this policy analysis began with the observation that education reform, particularly in Los Angeles but generally across the nation, was in a state of *permanent crisis.* The waves of education reform had failed to produce an institutional turning point or a big winner, either politically or educationally.[1]

The permanency of the crisis has been caused, in part, by the politics of education reform. For the past 40 years, the politics of public education has concentrated on governance and consequently on the rules, regulation and compliance that governance produces. In this context, education reform has largely become an effort to create organizational governance in which flexibility is possible. But instead of transformation, these reform efforts have largely produced seemingly endless auditions of new ideas. Each deviation from rule violates someone's interest and, more importantly, someone's sense of what is right, proper and legitimate.
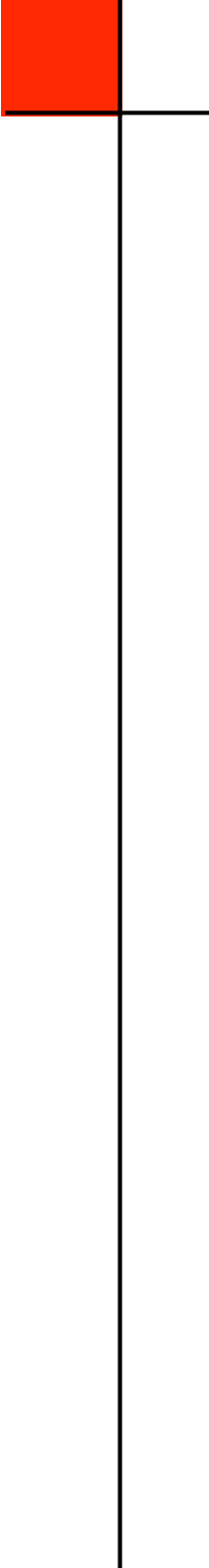
It is time to shift attention to capacity building.

The approach advocated here is to invest in changes in the system's capacity: build educational infrastructure. Create incentives and agency, particularly for students and teachers. Ease adoption through regulatory relief for school districts. Finance and study those who are working on the leading edges in district schools, in charters, in public and private ventures that constitute the country's education development laboratories.

I researched schools where people think outside the conventions of the century-old acquisition and storage model of learning, Learning 1.0, and where learning is organized in unconventional ways, providing a glimpse of what a new learning system might look like.

Just as the Progressive Era educators did a century ago, we need build an education system around the learning system. I call this Learning 2.0. It is a full-scale update of the old model, not destroying it but standing on its shoulders. Although the new system uses and relies on computer and Internet technology, its design relies as much on rearranging human activity as it does in introducing smart machines. Learning 2.0 is composed of five elements.

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[1] See: Mark Blyth, "Studying Educational Systems with the Tools of Institutional Theory," p. 153-168, in *The Transformation of Great American School Districts: How Big Cities are Reshaping Public Education*, ed. William Boyd, Charles Kerchner, and Mark Blyth (Cambridge, MA: Harvard Education Press, 2008).

1. A remix of acquisition and practice in project-based learning and other immersive pedagogies.

2. An individual education plan for everyone.

3. A realization that students, not adults, are the workers in the education system.

4. Unbundling teaching, learning and the assessment of competence.

5. Redefining the basic skills to add such 21st Century skills as learning how to solve difficult, ill-defined problems, and learning how to collaborate.

The vignettes in this report illustrate Learning 2.0's principles. At High Tech High in San Diego, New Tech at Jefferson High School in Los Angeles, and the Avalon School in St. Paul students learn by designing and completing projects. Parents tutor their children who are enrolled in the California Virtual Academy, and they integrate a highly structured curriculum with family life and experiences. As demonstrated at Los Angeles Unified School District's technology fair, hands on learning motivates students who had been "ganged up" and lost to any form of schooling recreate themselves as designers and graphic artists. At Rocketship, Claremont High School and other schools, blended learning—"clicks and bricks"— bring together technology and face-to-face experiences using Moodle and other software. Games, simulations, apps, and the burgeoning world of open lectures and courses grows daily. In Scotland, the country has invested in the world's first national education intranet, Glow, with the capacity of linking every student, classroom, teacher, and family in the country.

Each of these examples illustrates a new production system that differs from Learning 1.0's industrial batch technology in two ways. First, it employs a form of *flexible specialization,* a means of production capable of responding to the needs of individual customers quickly and economically. Second, many of the illustrations rely on *peer production*, social sharing and exchange to build things of value.

In the growing world of peer production, individuals cooperate to create goods and services without the intervention of firms or government agencies, although they may be enabled by them. Individual self-identification rather than management authority determines the division of labor in ventures, such as Moodle, Wikipedia or the virtual reality system Second Life. Peer production is possible because the Internet is different from other technologies because it passes the power of production and the ability to collaborate in production into the hands of individuals. It does not mean that all the capital necessary to process, store and communicate information is under individual control. That is not necessary. But with a very modest investment, individuals gain the ability to access information, to take from it, rework it and submit it back to the commons.

Learning 2.0.net

The relevant policy question is whether California can feasibly take steps that use the new production system to bring Learning 2.0 into being and to use the new production technology to build the capacity of the state's education system. I believe it can.

California needs to invest in a learning infrastructure for students, one that uses the new network production technology. Think of it as a combination of Facebook for school, the best computer game you ever saw, and a smart app for your mind. By thinking of the student as the end-user rather than designing educational products that will be attractive to a textbook adoption committee, the state can vastly open up learning to new participants, approaches and ideas.

Learning 2.0.net would contain information necessary for students and their parents to navigate schooling, teaching and tutoring in different modalities and styles, and the ability for students to test their knowledge and gain credit.
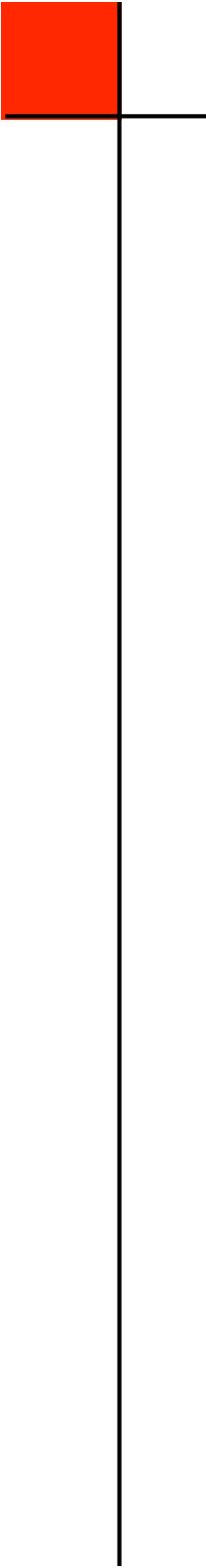
For students and their parents, information lights the pathway to college and career. By when should a child be redesignated as English fluent to have a good chance of getting into college? Why are class placement tests at a community college important? At a minimum, students and their parents ought to have on-line access to reliable information about where they are on a pathway, an educational GPS function.

The second part of Learning 2.0.net would offer a variety of learning experiences, or access to them. The number learning applications grows almost hourly. In fact, there is so much learning material on the Internet that Learning 2.0.net should function as an aggregator. Also, it should assist the development of particularly sophisticated applications, social or scientific simulations. And it can be the site for collaborating teachers and students.

The third part of Learning 2.0.net would allow students to take tests and get credit for learning. Students could take tests when they were ready, could pass courses when they were ready, could take tests as formative feedback. Unbundling teaching and testing also allows the whole education system to become more productive. If the financial rewards for school systems were correctly managed, it might also incentivize schools and districts to accelerate learning. And instead of drawing students away from substantive learning, substantive tests would motivate students and place the teacher in the position of a supportive tutor and coach to help them reach their goals.

Creating a Politics of Winners

Learning 2.0.net would change the politics of education in California by changing the way students interact with the tools of learning. By changing the way students and teachers work, it would activate new interests in education, and reshape the interests of well-established parties, such as teacher unions, parents, and school

districts. It would activate student and parent expectations of schooling. It would allow teachers to have field trials of new ways of arranging their work without frontally attacking the idea of a class or student-teacher ratios.

No state agency or district would demand its use as a matter of system design. Learning 2.0.net's growth would come about through practice adoption rather than mandate. Learning 2.0.net allows teacher unions and school districts to embrace technology without forfeiting the students, the revenue they bring to a school district, or the teacher jobs that revenue allows. Students would remain enrolled in their home school and district.

Learning 2.0.net could also serve an important educational laboratory function. All the new modes of learning are in their infancy and they need more of the D(evelopment) part of R&D. Instead of a standard design, California needs many laboratories. It would help preserve a legal commons so that the intellectual property of schooling stays in the public domain. And it would allow attaching school-finance and human-resources politics to productive changes in learning.

And more than anything, Learning 2.0.net will allow existing schools to be winners, politically and educationally.

The Politics of Learning 2.0: From Governance to Capacity Building

Why, one might ask, should California, the headwater of the digital revolution, be stuck in the eddies of early 20th Century school design?

Charles Taylor Kerchner
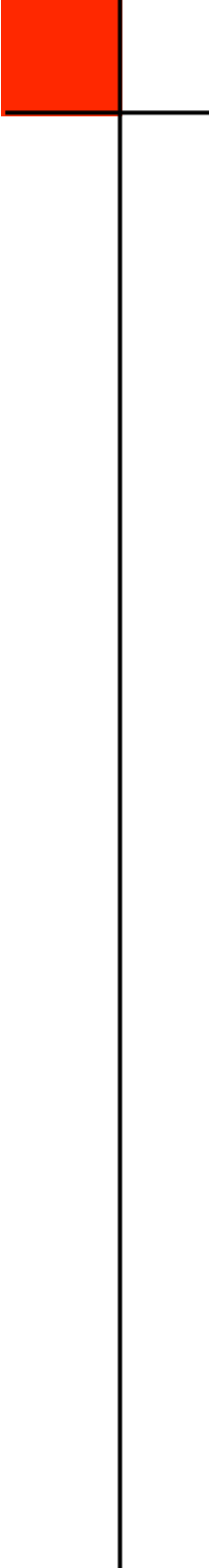
For the past 40 years, the politics of public education has concentrated on governance and consequently on the rules, regulation and compliance that governance produces. It is time to shift attention to capacity building.

It would be hard to overstate the extent to which running a school or district involves navigating a kelp bed of rules, each with entangling arms. Federal and state agencies and interest groups, including the much maligned teacher unions, have become compliance advocates and rule enforcers. In this context, education reform has largely become an effort to create organizational governance in which flexibility is possible. Thus, charter schools get public money with fewer restrictions than district schools, and big civic reform coalitions, such as LAAMP/LEARN or more recently Public School Choice in Los Angeles, operated around a promise of moving operational authority closer to the teachers and learners.

But instead of transformation, these reform efforts have largely produced seemingly endless auditions of new ideas. Each deviation from rule violates someone's interest and, more importantly, someone's sense of what is right, proper and legitimate. Charter schools become symbolized as "giveaways" of public money to private interests. Efforts to create civic coalitions are denigrated as the playgrounds of billionaires. Both in California and the nation, reform efforts tend to yield much less than their initial promise. In *Learning from L.A.,* we noted the tendency of successive reforms to audition the same ideas but never to see them fully adopted. The book calls the condition *permanent crisis*.[2]

It is unlikely that the deadlock of interests, rules and ideology will be broken by frontal attack. Despite the fact that wrenching power away from existing interests has become a primary policy effort for big city mayors and Midwestern governors, the evidence is piling up that the strategy is unworkable. Regimes come and go;

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[2] Kerchner, Charles Taylor, David J. Menefee-Libey, Laura Steen Mulfinger, and Stephanie E. Clayton. *Learning From L.A.: Institutional Change in American Public Education*. Cambridge, MA: Harvard Education Press, 2008.

interests stay. But circumstances change how groups and individuals gauge what is in their *best* interest. Thus, the goal of this essay is to explore how building the capacity for teaching and learning differently also changes the array of educational interests.

Instead of frontal attack, relatively small investments in new methods and modes of learning are challenging century-old notions about how learning should take place. The pathway for doing so, however, differs somewhat from the technology-adoption curve and power strategy laid out in the influential book, *Disrupting Class*.[3] The standard technology adoption curve only works outside of institutional constraints. Public education was purposely built to be institutionally constraining. The power strategy of blowing through opposition doesn't work because the array of interests is more long lasting than the self-styled reformers. I believe the path to substantive change is through capacity building that produces more political winners than losers, more avid adopters and users than resisters.

Public education is now in an unusual situation in which small investments in learning infrastructure can have substantial impacts in terms of capacity building and systems changing. Partly because of Internet technology, the political process has the capacity to create what I have called Learning 2.0, the next full-scale version of public education, and it is possible to do so without the political costs of frontal attack on existing interests.

I have visited schools where people think outside the conventions of the century-old acquisition and storage model of learning, and where learning is organized in unconventional ways, providing a glimpse of what Learning 2.0 might look like. I have visited High Tech High in San Diego, New Tech at Jefferson High School in Los Angeles, and the Avalon School in St. Paul, where students learn by designing and completing projects. I've watched parents tutor their kids who are enrolled in the California Virtual Academy, and seen how they integrate a highly structured curriculum with family life and experiences. I've visited the Los Angeles Unified School District's technology fair and seen students who had been "ganged up" and lost to any form of schooling recreate themselves as designers and graphic artists. I've looked at blended learning—"clicks and bricks"—that bring together technology and face-to-face experiences using Moodle and other software. I've looked at games, simulations, apps, and the burgeoning world of open lectures and courses. (MIT now has over 2,500 free courses online, and Carnegie Mellon has invested hugely in smart teaching software.) I've visited Scotland, and talked with the people who developed the world's first national education intranet, Glow, with the capacity of linking every student, classroom, teacher, and family in the country. The sketch of Learning 2.0 grew from these experiences.

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[3] Christensen, Clayton M., Michael B. Horn, and Curtis W. Johnson. *Disrupting Class: How Disruptive Technology Will Change the Way the World Learns*. New York: McGraw-Hill, 2008.

The Road to Learning 2.0

In order to understand the assertion that the political way forward is through building learning capacity rather than through compliance or governance changes, it is necessary to dip briefly into the history of public education over the last century. The history recitation is partly cautionary. Many of those who consider themselves reformers assume that they can recreate the old institution by admonishing people to work harder, using better data, or changing who is in charge. But the way forward is not through recreating the conditions under which Learning 1.0 worked better than it does now; it is through creating the conditions under which new forms of learning and information processing become part of public education.

Learning 1.0: The First Full-Scale Version of Public Education
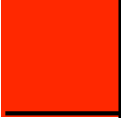
Beginning in the late 19th Century, the United States created its first full scale version of universal public education, Learning 1.0. It was built on an acquisition and storage model of learning and a civil service model of government organizations. The pedagogy packed young heads with enough facts and skills that students could make their way into the adult world, get jobs and raise families. Connections between the school and the economy were anticipated as early as grade five, and it was thought that perhaps 15 percent of students would require a high school education. The rapidly growing, immensely productive, industrial economy had places for workers with virtually all levels of educational attainment.[4]

The governance system for these schools rested on four conditions. First, there was—and remains in many quarters—a bedrock belief in local control. The United States, unlike most countries, did not develop a national ministry of education, and the national government did not finance the schools. Townships and cities provided, governed and largely financed their own schools with property taxes under the watchful but often remote eye of the state.

Second, Progressive Era reformers introduced the belief that schools should be removed from partisan politics, partly to remove jobs from the patronage system. Although the "apolitical" label was never completely accurate, it was generally held that serving on a school board was a civic duty, not a venue to advance a specific interest or a stepping-stone to higher political office.

Third, coherence in the highly scattered, localized education system was created by professionalism. Schools may have been the provision of a town or isolated village, but the teachers and administrators in those schools would have been educated and certified in one of the state universities or specialized institutions called normal

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[4] For a comparison of new and old institutional forms and case studies of districts in flux between them, see: Boyd, William Lowe, Charles Taylor Kerchner, and Mark Blyth, (eds.) *The Transformation of Great American School Districts: How Big Cities Are Reshaping Public Education*. Cambridge, MA: Harvard Education Press, 2008.

schools that were being created throughout the country. (In California, these were the precursor institutions to the California State University System.) Long before it adopted collective bargaining, the National Education Association was a strong professional network, and it formed one leg of an historic iron triangle, which, along with big city superintendents and a select group of college deans, formed a virtual "education trust" providing central direction to a highly decentralized education system.[5]

Fourth, the entire system was built on a self-sealing logic of confidence. In greater or lesser measure, the schools were sealed off from harsh public criticism and close inspection. Internally, zones of autonomy were created for principals, particularly high-school principals, to operate their schools with relative freedom, provided that certain cultural and organizational norms were not violated.[6] These norms, which have been called "the grammar of schooling," created sameness to the way American schools looked and operated despite their dispersion across a continent.[7]

These changes echoed a broader social movement that tried to steer the United States between the emerging ideas of Marxism and the increasingly dysfunctional ideas of laissez faire economics that had produced violent swings in the economy and extreme inequality, not unlike that which the country is now witnessing. Walter Lippman's *Drift and Mastery,* written in 1914, was a widely acclaimed call to apply science and scientific management to the country's problems. Well run, efficient government was a viable answer to social ills.[8]

In the following decades, public education across the country was built in the model of an efficient, well-run public corporation, and as historian Judith Raftery would write: "By the mid-1920s administrative Progressives in Los Angeles had succeeded in remaking their school district on the model of the scientifically managed corporation."[9]

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[5] Tyack, David, and Elisabeth Hansot. *Managers of Virtue: Public School Leadership in America, 1820-1980*. New York: Basic Books, Inc, 1982. A particularly instructive example of how ideas spread and were made the norm can be found in the *school survey* teams composed of visiting educators (p. 162f).

[6] Meyer, John W., and Rowan, Brian. "Institutionalized Organizations: Formal Structure as Myth and Ceremony." *American Journal of Sociology* 83, no. 2 (1977): 340-63.

[7] Tyack, David B. "The Grammar of Schooling: Why Has it Been So Hard to Change?" *American Educational Research Journal* 31 (1994): 457-79.

[8] Lippman, Walter. *Drift and Mastery: An Attempt to Diagnose the Current Unrest*. New York: M. Kennerley, 1914.

[9] Raftery, Judith. *Land of Fair Promise: Politics and Reform in Los Angeles Schools, 1885-1941*. Stanford, CA: Stanford University Press, 1992, p. 15.

Hollowing Out Learning 1.0's Institution

But by the 1980s both faith in government performance in general and in big city school systems in particular had collapsed. Confidence in public schools was damaged by an emerging free market ideology, the civil rights movement that illustrated the failure of schools to educate poor and minority students, and demographic shifts that concentrated poverty.

Reform efforts multiplied, particularly after 1983 when a crisis in education was declared, and when one examines education reform in Los Angeles and other large cities, such as New York, Chicago, Philadelphia, and Washington, D.C., it becomes apparent that all four of the founding institutional conditions have been violated:

1. Local control has been replaced by federated control, with increased governing power vested at the state and federal level, and education policy is driven by networks of commentators, analysts, and activists with distinct ideological agendas.
2. Apolitical governance, characterized by nonpartisan election of civic elites, has been replaced by pluralistic governance including powerful interest groups with strong loyalties to local and national political parties. Coalitions among the interest groups shift over time, for example the relationship between teacher unions and the Democratic Party, or the relationship of charter schools and political conservatives.
3. The professional hierarchy has ceased to dominate to the extent that school administration has been called "a profession without a practice." Non-educators frequently occupy superintendencies in big cities. Technical specialists, trained in other fields, frequently occupy second- and third-level administrative positions once reserved for career educators. School operations are more frequently contracted out, and charter schools are often considered part of a region's portfolio or network of schools.
4. Confidence has been replaced by inspection. Externally created tests drive school administration and highly influence the reputation of schools. Outcomes are linked to largely negative incentives and actions. Poor student results or leaving school before graduation is characterized as system failure and discrimination, rather than a lack of individual achievement.[10]

Reforms were supposed to take these new conditions and shape them into an institution. But when one examines reform efforts across the country, and particularly in Los Angeles, it becomes apparent that there has been a massive failure of politics to transform education. Instead, something close to a permanent crisis has resulted in which the system bumps from one initiative to another, one

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[10] Boyd, William Lowe, Charles Taylor Kerchner, and Mark Blyth, (eds.) *The Transformation of Great American School Districts: How Big Cities Are Reshaping Public Education*. Cambridge, MA: Harvard Education Press, 2008.

declared crisis to another, without much systems transformation. Much singing, but no opera, as one veteran reformer put it.[11]

Why the Deployment of Existing Interests Are Deadlocked

Given the extremely polarized state of politics, it is unlikely we will see something approaching a grand bargain, education rising above the partisan fray, in the near future.   There may be some re-creation of a civic culture in Los Angeles as a result of the L.A. Compact, but it is apparent that even the advocates of the compact cannot straddle the knife-edge of controversy. Clearly, Los Angeles and California need to build civic capacity, but nothing like the "party of California" or unitary politics appears in the offing. It is also unlikely that there is a workable power strategy, a takeover political force sufficient to push a singular educational idea to the front. This strategy, favored by many, has proven insufficient and temporary in the places where it has been tried. Mayoral and civic takeovers in New York, Chicago, Philadelphia, and Washington, D.C. have proven to be more contentious than efficacious, more temporary than institution changing.

Many of the current reform ideas are ideological fairy tales. Except for very small glimpses, the market-as-reform narrative contains no systemic thinking, no adoption path for new ideas, no realistic view of how the hidden hand would accomplish change other than by creating a managerial and governmental autocracy that cuts against the political beliefs of most of the people advocating deregulation and market solutions. Both the unbridled denigration of public schools and those who teach in them, and the policy proposals themselves represent only the second half of capitalism's famous creative destruction. Existing efforts at creativity through charter schools are self-limiting and inherently small scale. Charters have produced some stunning examples, but overall a mixed record at best, this despite billions in philanthropy and government-grant support along with regulatory relief. The portfolio-of-schools idea of turning school districts, such as Chicago, Philadelphia, or Los Angeles, into holding companies that would invest in winners and shed losers, has proven much less robust than its advocates would wish.

Thus, at root, public education lacks a mechanism for converting the schools it has to the schools it wants. I believe that route is through changing teaching and learning rather than frontal attacks on governance. Governance will change, but it will lag, not lead, for change in governance for its own sake creates contention and conflict without necessary organizational change. Without first changing how learning takes place, the historic grammar of schooling will simply reproduce itself under new management.

The approach advocated here is to invest in changes in the system's capacity: build educational infrastructure. Create incentives and agency, particularly for students

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[11] Kerchner et. al., *Learning from L.A.,* p. 203.
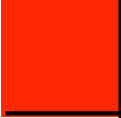
and teachers. Ease adoption through regulatory relief for school districts. Finance and study those who are working on the leading edges in district schools, in charters, in public-private ventures that constitute the country's education development laboratories.

The Elements of Learning 2.0

Just as the Progressive Era educators did a century ago, we need to begin with a learning system. I call this Learning 2.0. It is a full-scale update of the century-old model, and although it uses and relies on computer and Internet technology, its design relies as much on rearranging human activity as it does in introducing smart machines. Learning 2.0 is composed of five elements.

1. A remix of acquisition and practice in project-based learning; or as the founders of High Tech High in San Diego call it, the integration of head and hands. Integrating experience and academic standards creates multiple pathways through school without old-fashioned tracking, and it often changes students' aspirations. Larry Rosenstock, who founded High Tech High, realized that more of the students in his carpentry class were going to college than those in the school's "academic" track. Learning and doing motivates students, and changes the flows of information.[12]

2. An individual education plan for everyone. The official curriculum of most schools leaves large numbers of students either bored or bewildered. Both in the speed at which knowledge is presented and the style of learning experiences, the system needs more variety in type and style of education, not less. Individualization and specialization of learning will allow different mixtures of technical, artistic and conventionally academic education to co-exist and prosper. New technologies help. The software for handheld devices, such as that developed by Wireless Generation, allows teachers to individualize and regroup students while constantly monitoring their progress.

3. A redefinition of who is the worker in the education system. Historically, education reform has been built on getting adults to work harder hoping that this would make kids smarter. Instead, we need to design and build learning experiences that are accessible directly by students and which better motivate them. Given data about standards and expectations and the expanding universe of educational experiences, students are capable of much more self-monitoring and direction than the current system expects or allows.

4. Unbundle the time spent learning, teaching lessons and the assessment of competence. While the current practice of semester-long classes may endure for some time, the system needs to open the capacity for students to learn and be tested in different blocks of time, and to be certified as having learned. If there are productivity gains to be made in education, they will be made largely in shrinking the number of years and months it

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[12] Short commentaries about most of these elements can be found at: www.mindworkers.com.

takes a student to move through high school and higher education and by reducing the necessity for remediation for students who simply needed longer to master a topic.

5. A redefinition of Basic Skills. The United States has been obsessed with higher standards in reading, math and science. But standards and testing are dangerously narrowing learning. Learning to collaborate and to solve ill-defined problems are to the 21st Century what industrial discipline was to the last 100 years, according to those who have studied what employers and society need. Adoption of a common core of standards, to which the California State Board of Education has subscribed, is supposed to address these issues, but the danger remains that these standards—like the existing ones—will produce a longer list of atomized, and thus trivialized, skills.

These five elements both challenge and build upon the batch processing learning production system created a century ago. In order to better understand Learning 2.0, the following vignettes provide examples from schools that practice some of its five elements.

HTH: A Remix of Knowing and Doing
The words "remix" and "mashup" entered the vocabulary as descriptors of life in the digital age. They are also key to Learning 2.0.

At the simplest level, these new terms are represented by three teenagers using Apple Garage Band to combine bits and pieces of music into their own composition. At a more complex level, the process of remix changes the nature of authorship, as it did for a recent book on digital learning in which the authors of the draft posted their text for comment and addition. Hundreds of people responded, and the book draft is still undergoing revision even after its publication by a university press.[13]

Remix and mashup are linguistic markers for a growing practice of peer-produced learning that extends the instinct for tinkering and play into an approach to learning and scholarship. As pedagogy, these new words signal moving away from consumption to participation and from concentrating our attention on teaching to concentrating on learning. The shift in learning is not necessarily computer driven. As Connie Yowell, director of education at the MacArthur Foundation notes: "Our digital media and learning initiative is not about technology, turning our backs on teachers, or throwing out traditional literacy skills. It is about what people do with digital media — especially the potential for peer-based learning."[14] Indeed, the instinct for peer learning by doing infused the philosophy of John Dewey a century ago.

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[13] Davidson, Cathy N., and David Theo Goldberg. *The Future of Thinking: Learning in a Digital Age*. Cambridge, MA: MIT Press, 2010.

[14] MacArthur Foundation. *Re-Imagining Learning in the 21st Century*. Chicago: Author, 2009.

A glimpse of this world can be found in Exhibition Night at High Tech High in San Diego. Students at HTH learn from a pedagogy that deliberately integrates things that schools and society have sought to separate: head and hands, school and community. Thus, students in biology demonstrated their latest fieldwork, the DNA typing of samples from San Diego Bay. The students' trips to the shore are not casual encounters, but real science that has led to six published books. Science is linked with history and language arts. As biotechnology teacher Jay Vavra says pointing to the English classroom across the hall, "Remember *Cannery Row*? I'm Ricketts; he's Steinbeck."

Once a year, HTH students present their work to parents and the community. These evenings are more than a Science Fair; the act of explaining one's work is part of the curriculum. In 2010, Exhibition Night included student-written plays, a textbook on economics illustrated with linoleum block art, a conceptual art exhibit that was the product of lessons in geometry. The crowd pleaser of the night was a homicide scene complete with a dead mannequin, crime-scene tape, and blood splatters. In his lab coat, the presenting student shows listeners how he and his fellow students were able to use geometry to determine the height and weight of the perpetrator and the type of murder weapon. (Conclusion: The teacher did it; her DNA was found on a toothbrush left at the crime scene.)

Head and hand integration are also present at The Stanley E. Foster Construction Technology Academy, a San Diego Unified School District high school just miles away. The school has broken down the traditional 7-period high school day into instructional blocks that allow students to pursue traditional academic subjects and exciting projects at the same time. In 2007, some 81 percent of the graduates were accepted in colleges.

Unfortunately, educators and policy advocates are deeply divided about how and whether to create schools that combine learning and becoming. Recently, Robert Schwartz, academic dean of the Harvard Graduate School of Education, did verbal battle with Kati Haycock, president of Education Trust, with Haycock saying that career-focused programs would mean giving up on the resources that low-income and minority kids need to succeed in school.

Schwartz and his colleagues had recently published *Pathways to Prosperity* that, among other things, criticized the college-for-all strategy as doomed to failure without much stronger career-oriented programs. Although the employment market is steadily demanding more education, they note, the largest employment bulge, and the greatest wage premium, appears for jobs requiring post-secondary licenses or certificates rather than bachelor's degrees.[15]

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[15] Harvard Graduate School of Education. *Pathways to Prosperity: Meeting the Challenge of Preparing Young Americans for the 21st Century*. Cambridge, MA: Author, 2011.

Linked Learning

Schools like High Tech High and the Construction Technology Academy have allowed practice to transcend the century-old debate over the value of academic versus vocational education. They want both. They believe the symbiosis engages students who would otherwise drop out or who would glide through high school's path of least resistance.

Several California educators and organizations have been attempting to craft a practical solution. Under the names Multiple Pathways or Linked Learning, policy advocates such as Jeannie Oakes at the Ford Foundation and David Rattray at the school and employer partnership, UNITE-LA, seek to create policies and practices that bring academic and career education together, getting beyond tracking.[16] Los Angeles Unified schools provide some vibrant examples:

Ninth grade students at the School for Global Studies near downtown Los Angeles tackled a project to support undocumented students who are headed to college, a homegrown version of the Dream Act. Their task, under the shell of a project designed by their teachers, was to design a fundraiser that would help these students with enough money to pay for their college applications. The students I heard thought that luscious strawberries dipped in chocolate would be a sure seller. They used their algebra skills to plot a break-even point and figure profit margins at different production levels, their English language arts skills to promote the effort, and their digital media skills to produce a mouth-watering video.

In the process of completing projects, students learn teamwork and self-monitoring. They divide up the work and hold one another accountable. If a student fails to produce, it lets the whole team down, and they—the other students—will intervene with the errant student and his or her parents. Students also learn important oral communications skills. Meanwhile, the students' teachers continue to provide lessons, quizzes and reading related to California standards and the test items and question forms used on the California Standards and the high school exit exam.

At a training facility near LAX, the Police Orientation and Preparation Program links the school district, West L.A. College and the Los Angeles Police Department. Students, who come from any school in the city, enter as seniors or as community college freshmen. The high school students can finish their college-entry required courses and earn college credit while finishing high school. In two years it is possible for a high school senior to have graduated, earned an AA degree, and received a certificate qualifying them to work in a private security firm. They also have a leg up on candidacy for the LAPD academy.

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[16] Oakes, Jeannie, and Marisa Saunders, (eds.) *Beyond Tracking: Multiple Pathways to College, Career, and Civic Participation*. Cambridge, MA: Harvard Education Press, 2008.

The police preparation program and Global Studies Academy prepare students for college and careers simultaneously. In California, unlike many other locations, the state's flagship university reviews individual course descriptions from public and private high schools to determine whether they meet entry requirements, known as the A—G requirements. More than 5,600 courses, about 20 percent of all career-technical education offerings, already satisfy University of California entrance requirements. UC also sponsors the Curriculum Integration Institute, where academic and career technical-education experts meet to design integrative model courses.

As well as university standards, Linked Learning requires real world, craft and artistic standards. For example, ACME animation, a non-profit organization, connects high school and college students with professional animators. ACME grew from the teaching experience of Dave Master, who started an animation program at Rowland High School, east of Los Angeles, in 1977. High school students begin as auditioners, but even from the start their work is subject to professional standards and critique. No sugarcoating. And the same method—not unlike introductions to the historic artisanal guilds—is used for more advanced students who want to earn a living in animation. Professionals donate their time, and more than 3,000 students in 35 schools and colleges nationwide participate. Four of these schools are in the Los Angeles Unified School District.
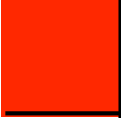
Because Linked Learning or Multiple Pathway runs counter to many of the deep structures of American high schools, the multiple pathway idea becomes tractable only because each pathway is usually contained in an "academy" within a larger school or a small school, such as a magnet, charter or pilot school. While it is not surprising that the autonomy granted charter schools has allowed them to become a host to many Linked Learning projects, the ability of existing public districts to do so within existing institutional constraints suggests much greater innovative potential than is commonly thought.

It's difficult work, but it is one of the areas of education where California is a national leader. The James Irvine Foundation has heavily supported Linked Learning, including founding ConnectEd, the California Center for College and Career.[17] A number of organizations, including the Buck Institute and the New Tech Network, provide introductory training and an extensive library of projects that schools can adopt.[18]

The High Tech High organization has taken practical steps to spread project-based learning. Teaching and learning there is highly transparent: hundreds of examples on the school's web site, explanations of the project based method, and particularly

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[17] http://www.connectedcalifornia.org/; http://irvine.org/;(Accessed January 1, 2012).

[18] http://www.bie.org/; http://www.newtechnetwork.org/ (Accessed January 1, 2012).

what it isn't, and thousands of visitors a year. HTH has also started its own graduate school that offers both credentials and master's degrees. Students are largely teachers at the HTH schools, but enrollees are also being drawn from afar to programs that require only short residency at the school.[19]

School of One: Individual Daily Prescriptions

The School of One originated in the New York public schools, designed by Joel Rose, who headed the New York City Department of Education human capital efforts. In 2008, Rose, who had been an elementary school teacher in Houston, set out to radically improve the system of learning math for middle school students by individualizing it.[20]

School of One operates in three middle schools staffed by regular district employees. Rose's idea of individualizing multiple modalities requires a much more complex system than simply introducing computers in the classroom. He recalled his teaching days when someone from the district delivered three computers to his classroom: "Three kids are on the computer; I'm working with 24…one kid finished early he wants to come in…the other two are hitting each other…I got them to stop…one kid said he was absent yesterday and he missed his turn…can he go back? It made my job harder. We've taken this technology and cascaded it on the teachers."[21]

To make the technology work for students and make jobs better for teachers School of One developed a learning algorithm that creates a unique schedule for each student, each day. Students see this on flat screen monitors that tell them where to go and what to study next. Some will work at computers, some will work in small groups, usually fewer than 10 students with a teacher.

Driving the algorithm is a learning map of some 4,000 skills that lead a student from 4th grade level—the skill level of some students as they enter middle school— through 9th grade. These are linked in webs and pathways. Students enter the learning map via diagnostic tests, and each gets a "playlist" of things to study next. Students, their parents, and their teachers fill out surveys about how they like to learn: in groups, working problems alone, with games, at computers, listening to the teacher.

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[19] For a longer case study see: Kerchner, Charles Taylor, *The Emporer's Clothes: High Tech High Mystique and Reality*, 2012, available at: http://www.mindworkers.com.

[20] Rose left the New York City Department of Education in April 2011, to found an independent foundation: http://blogs.edweek.org/edweek/DigitalEducation/2011/03/rose_leaving_school_of_one.html

[21] For Rose's talk at EdSource 2011: http://www.edsource.org/event-forum11-video3.html

The algorithm is linked with resources. The School of One team of experts examined 25,000 math lessons that were linked to the skills students needed, and picked the 5,000 they thought best. These resources come from a large number of providers, some small, some large organizations such as Pearson and McGraw-Hill. The final element in the system is a daily computer assessment that checks for understanding at the end of the day and creates the next day's playlist.

Avalon and CAVA: Student as Worker in the System

Most education reforms start with the premise that adults need to work harder so students will learn more. But ultimately, maybe quickly, that premise is self-defeating. Regardless of the pedagogy used, who governs the school, or how long teachers toil, students are the real workers in the system. Building around that reality is one of the five key elements of Learning 2.0, the next full-scale version of public education.
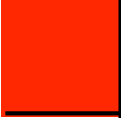
Thinking of students as education workers invites us to consider them as producers rather than consumers of education. In truth, of course, they are both. Outside of education, and particularly in medicine, the system has recognized that good outcomes depend much more on what clients do than what professional practitioners do. The "prosumer" relationship, as futurist Alvin Toffler called it, is built into integrated health care systems.[22]

Health maintenance organizations provide their clients with handbooks and web sites for self-diagnosis and treatment. The standards of professional care are available to clients and their advocates. Rather than threatening professionals, building client knowledge allows a more productive and deeper relationship to exist between patient and professional.

If students are the real workers in the education system, those who design public education need to ask: what sort of responsibility is it reasonable to require students to take for their own education and how should the system be constructed to best motivate students to take such responsibility?

The phrase "student as worker" was popularized by the late Theodore Sizer to counter the common perception of a teacher as a deliverer of instructional services. In Sizer's Coalition of Essential Schools, student-as-worker is associated with a coaching or guide-on-the-side kind of teaching in which students themselves grapple with projects and problems. But the notion of student-as-worker extends beyond the always-charged discussion about coaching versus direct instruction; it asks how student motivation can be increased in design of schooling. In quite different ways, the practice of building school around the student as the school's worker is found at

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[22] Toffler, Alvin. *Powershift: Knowledge, Wealth and Violence At the Edge of the 21st Century*. New York: Bantam Books, 1990.

the Avalon School in St. Paul, Minnesota, and in the students who attend the California Virtual Academy.

Avalon School

Students don't spend much time in class at Avalon School. For most of the school day, and for most of their high school careers, students at the 187-student charter school work on projects of the student's own design. In its pedagogy, it's more like a graduate school than a secondary institution.

Avalon also has two other characteristics that make it highly unusual. Teachers, who divide the duties normally taken by administrators, including evaluation and hire/fire decisions, run it. Students, who operate the school's Congress, make and enforce most of the rules.

A project at Avalon is not something that a student does in class, as is typical of most schools; it's something done instead of going to class. Each student has a notebook containing the Minnesota graduation standards. A student's job is to design projects that meet those standards. A student writes a proposal that describes the project, what resources will be necessary, and the timeline. A teacher (called an advisor at Avalon) approves, as do the student's parents. Then a student sets to work.

The school room looks much more like an office than a classroom. Students have individual, adult sized workstations with either school-supplied desktop computers or their own laptops. They read; they acquire skills—interviewing or statistics, for example—necessary to complete their projects. They confer with their advisors, but the pace of the project is theirs. Self-discipline is one of the lessons Avalon students learn, maybe the most important one.

Avalon works because teachers and students adopt a much different division of labor than is typical. A student's job at Avalon is learning. He or she can't come to school just to hang out or steer the path of least resistance. Sleeping, pleasure reading, or doodling may be tolerated, but it doesn't gain one any high school credit, and sooner or later students come to realize that they, rather than their teacher, will determine if they graduate and how they are prepared for adulthood. A teacher's job is supporting students and running the school.[23]

CAVA: A Take-home Curriculum

The people at the California Virtual Academy are adamant that CAVA is not in the home-schooling business, even though its students study in their bedrooms or family

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[23] For a longer case study see: Kerchner, Charles Taylor. *Can Teachers Run Their Own Schools: Tales From the Islands of Teacher Cooperatives*. Claremont, CA: Mindworkers.com, 2010, available at www.mindworkers.com.

rooms under the watchful eyes of (usually) their moms. Home schooling, under the traditional definition, meant parental development and control of what is taught. K-12, the for-profit corporation that is the pedagogical engine of CAVA, prides itself on a highly integrated system of lessons, workbooks, on-line delivery, assessment and interpersonal supports. It is a more coherent and tightly controlled curriculum than that found in most brick and mortar schools.

Yet, regardless of these supports, CAVA doesn't work unless students engage. Although CAVA students can access their virtual classroom anywhere an Internet connection is found, the vast majority conduct their learning from home under the watchful eye of their "learning coach," most often a parent or grandparent. CAVA provides enrolled students with a loaner computer, printer, software, subsidized Internet connection and all books and curriculum materials for the entire year, free of charge.
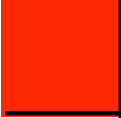
Students "attend" class by having their parents log attendance minutes online. The computer is also the location for class management tools, learning schedules, assessment exams and interactive lessons. Each student is assigned to a credentialed California teacher who grades student work, monitors student progress and administers all standardized tests. The teacher is also available to help with questions or problems that the student or learning coach may have.

The CAVA program consists of four primary elements: books and study material delivered to the home, the online K-12 developed curriculum or On Line School (OLS); CAVA teacher-designed lessons distributed via Elluminate Live!, an interactive web-based conferencing program; and Study Island, a video game-like website that is built directly from the California Content Standards that helps with CST preparation and to reinforce lessons.[24] CAVA also offers a 10-lesson course for success prior to state testing which offers students test-taking strategies, etc.

Teachers monitor students' attendance and progress through the curriculum via the CAVA online database. CAVA administrators describe the CAVA program as "dummy proof" for the learning coaches—every lesson is scripted and every lesson is assessed.[25] They also point out that the K-8 program is mastery-based which gives students the time to mature so that by the time they are 8th graders they are independent learners. CAVA teachers offer an "educational prescription" tailored to

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[24] Elluminate Live! communication tools include integrated voice over IP and teleconferencing, public and private chat, quizzing and polling, emoticons and a webcam tool. The software includes several visual tools, including whiteboard, application sharing, file transfer and web tour. The software also includes a record feature that allows the moderator to record the class for others to watch later as well as a graphing tool, breakout rooms for group work and timer. The whiteboard supports the uploading of presentations for viewing on the whiteboard for classes or meetings. See http://www.elluminate.com.

[25] Abston, Katrina, personal communication, February 4, 2010.

each student. The virtual environment gives them an opportunity to more easily individualize or, in educational parlance, "differentiate" instruction.[26]

Rocketship: Rebundle, Teaching, Learning, Growing Up

For the past century, teaching, testing and growing up have been tied into a bundle called school. Schooling was a mixture of maturation and mental exercise, of intense bonding among peers under the watchful eyes of adults, who understood more than students thought they did.

In the high-trust education institution that existed for the first six decades of the past century, a teacher's grade book and periodic report cards were the definitive and authoritative statements about a student's achievement. External testing was relatively unimportant, except for the relatively few students headed toward selective colleges and universities for whom scores on the SAT or the ACT were weighty. Teachers also became gatekeepers and sorters of students in formal and informal ways, pointing students toward college or toward the schoolhouse door.

In the intervening decades, public education has moved from a high-trust and organizationally closed institution to one that is low trust and externally examined. The drawstrings around the tight bundle of teaching, growing up and assessment loosened in several ways:

- External examination has become much more determinant of a student's path toward college and career. Student performance on examinations has become a gateway to the future.
- The Bell Curve expectations have flattened, replaced by universal high standards backed up by state and federal accountability measures.
- The sources of direct instruction and interactions that teach have multiplied.
- Teacher attention to the "growing up" part of schooling is subordinated to attention to the official curriculum.

The old bundle has clearly come apart and a new, dysfunctional bundle of teaching and testing created. One does not have to be a signatory to the Save Our Schools movement to observe that external testing is driving instruction in counterproductive ways. Accountability pressures have narrowed the curriculum, particularly in high-poverty schools where test scores are the lowest and schools most likely to be labeled as "failing." The attachment of sanctions to test results has created strong incentives to game the system and cheat on the tests themselves. The ability of school districts to link their official curriculum to tests over specific units of instruction have increased external monitoring of classroom results but often without good

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[26] For a longer case study see: Mulfinger, Laura Steen, and Charles Taylor Kerchner. *California Virtual Academy: At Home and Blended Learning*. Claremont, CA: Mindworkers.com, 2011, available at www.mindworkers.com.

programs of formative assistance. One example of rebundling the relationship has taken place at Rocketship Schools.

Rocketship Schools

Three Rocketship schools serve about 1,200 students in San Jose, California. Founders John Danner and Preston Smith realized that teachers in low-income urban schools spent a great deal of their time in repetitive routines to teach basic skills. Kids get the basics they need. But if whole classes are engaged this way, no one moves to advanced levels. So, they designed a model that provides individualized practice with tutors and computers and allows teachers to use classroom time to emphasize advanced critical thinking and problem solving.[27]

The extended school day is designed in longer-than-usual blocks to allow classes to concentrate on deeper learning, and 100 minutes a day are devoted to what are called learning labs: small-group learning, computer-based instruction, and independent reading time. The most struggling students also participate in after-school tutoring.
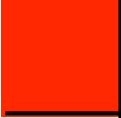
Community-based tutors, rather than certified teachers, work with students in the learning labs. They are provided with high quality routine lessons and assessments. Differentiated staffing and block scheduling make it possible for three certified teachers to reach the same number of students as four teachers would in a conventional 25-student classroom.

The results of a tight design, lots of technology resources, and differentiated staffing have propelled Rocketship schools to somewhat stratospheric test score levels. In 2010, its first school, Mateo Sheedy Elementary, where 80 percent of the students entered as English Language Learners and 78 percent qualified for free or reduced price lunches, scored 925 on California's Academic Performance Index. The state average for non-low income students is 869; schools in the surrounding local district average 792.

Avalon and High Tech High also provide examples of rebundling the relationship between teaching, testing and growing up. At Avalon, by creating what Douglas Thomas and John Seely Brown call a "bounded and structured environment that allows for unlimited agency to build and experiment within things within those boundaries"—in other words, a space with rules and lots of freedom within—the school links the completion of school work with the self-discipline necessary to grow up.[28] It largely removes teachers from the role of rule enforcers and greatly

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[27] For presentation by Danner at Ed Source 2011: http://www.edsource.org/event-forum11-video3.html

[28] Thomas, Douglas, and John Seely Brown. *A New Culture of Learning: Cultivation the Imagination for a World of Constant Change*. Author, 2011.

enhances their role as a coach or guiding adult. These structured spaces also appear at High Tech High-brand schools, although teachers rather than students design the projects and projects are group rather than individual work.

New Basic Skills

Learning to collaborate and to solve ill-defined problems are to the 21st Century what industrial discipline was to the last hundred years, according to those who have studied what employers and society need. They need to be considered *basic skills* just as are reading, math and science.

By the turn of the millennium, it was clear that jobs requiring routine thinking and skills were giving way to those involving both higher levels of knowledge and also some applied skills, such as expert thinking and complex communicating that are not well captured by most current educational standards or taught in the conventional curriculum. Teamwork, for example, is taught mostly in extra-curricular activities.

But how to do this? If we as a society want creativity, if we want people to know how to work together, where do we teach it? How do we assess it? The current policy path links new basic skills with a new generation of tests that will be a part of the Common Core of Standards.

But the tests and the Common Core face a very long developmental chain and growing political opposition. A whole series of decisions has to fall the right way for tests and curriculum to emerge and be adopted. And all that happens *before* classrooms start to change.

Consider, for a moment, a parallel policy pathway. Instead of using educational policy to produce new tests that are to drive instruction, why not turn the process upside down and create accessible forms of learning that involve the new basic skills? Let changes in learning drive the tests.

Claremont High: Changing the Nature of A Class

A merger of new and old basic skills can be found in a number of schools, including HTH and Avalon. At Claremont (CA) High School, Cheryl Fiello, armed with a master's degree in education technology, dipped into her own pocket for the $50 web hosting fee and downloaded Moodle, the free open source instructional management system, for her advanced biology class. That was in 2006. The next year, three teachers used the system, and the school district agreed to put it on its server and support operations. The following year, the adoption curve shot vertical. Now 200 courses at Claremont's high school and middle school are available online: assignments, references, study groups, forums. Over 4,500 students are enrolled.

Each teacher who puts up a course modifies the Moodle shell to fit his or her needs, all with drop-down menus and widgets and without any programming. Even so, Moodling is voluntary. Some faculty are resistant to its charms; others engage in

what Fiello calls "shovelware," scooping up the contents of their traditional course and putting it online: "That doesn't take advantage of any of the capacity of the system, but it's okay as a way to start." Fiello says that she looks back on her own courses of five years ago and cringes at how rudimentary her own use of technology was then. People grow, she says, and the system encourages growth.
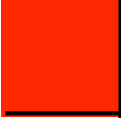
Moodle has changed what and how students learn in Fiello's class. The class management part of the system moved responsibility for managing assignments to students and relieved faculty of constantly reminding students of most scheduling and information issues: the calendar, assignments, deadlines, and handouts. "I don't have to put together packets of assignments for a student who missed school," she says. Students submit their papers and assignments on Moodle or via Google Docs. Parents also log in to track their children's assignments making Moodle an electronic nag enabler. In fact, parents have come to expect that teachers will have courses and assignments posted so they can see them.

In Fiello's class, the Moodle-based system also introduces the skills of collaboration and problem solving. Moodle's origins were with a constructivist approach to teaching, and the student forum in Fiello's biology class shows students engaged with one another, bringing examples, and amplifying the assignments in ways that would be impossible with a conventional text and lab book. Her class has become nearly paperless and without lectures. "The assignment for the evening might be to look at a lecture on YouTube." There is more class time for labs and discussions, and student discussions extend into the small hours of the morning—following the adolescent biological clock. "They have access to learning 24/7," says Fiello.

Students have the freedom to collaborate, but within a bounded space. Fiello and her colleagues have become less managers of routines and more developers of curriculum, guides to its use, and moderators of students using it. Access is password protected, and there have been no reported incidents of unwanted visitors. Faculty can, and do, monitor how students are using the system, and what they are saying to one another. "At first, students are naïve about Moodle, like they are about the rest of the Internet," says Fiello. "They think that they can say anything and no one will notice, when exactly the opposite is the case. After a while, students come to understand that this is school, not a free form chat. They change what they say and how they say it."

Kara Evans, who teaches English, notes that the most verbal students in class are not necessarily those who are the most active in the on-line forums: "I've got students who wouldn't ever volunteer in class, who will go for weeks without saying a word, who are all over the forum discussions. It's like someone turned on a switch." The asynchronous communication afforded by the on-line forum allows students to craft a response rather than popping up with an answer.

Evans encourages online discussion, which at first can be a little daunting. "Imagine putting out a topic and coming back the next morning to find that there were 350 responses. A teacher's first thought is, 'do I have to read ALL that?' and the answer

is that we develop pretty good skimming skills." Evans also encourages e-mail correspondence with students. They write in the class Moodle space, the messages are relayed to Evan's email account, which forwards them to her phone. "I've gotten messages in the summer, when I'm sitting at the beach," she says. Managing student expectations in an online world becomes a new craft element for teachers.

Both Evans and Fiello report the relative ease of differentiating learning and the ability of the online additions to allow students learn at their own pace. A student can spend a lot of time or a little time on an assignment, and the speed at which they progress is less important than in a conventional class. Special education students appear to do well in this environment.

Evans is piloting a hybrid online and traditional classroom senior English course. Instead of attending class every day, students come only on Monday and Fridays; the rest of the time students attend online. The course is popular with students who are working or who have otherwise over-scheduled lives. As it turns out, the course was also popular with students who just don't like studying English, who thought it would be an easy way to bag a requirement. They have been disappointed. Virtual learning requires real work.

A New Production System

Each of these examples illustrates a new production system that differs from Learning 1.0's industrial batch technology in two ways. First, it employs a form of *flexible specialization,* a means of production capable of responding to the needs of individual customers quickly and economically. Second, many of the illustrations rely on *peer production*, social sharing and exchange to build things of value. Flexible specialization is a term coined by MIT professor Michael J. Piore to capture what he saw as emerging from the previously dominant mass production manufacturing. How our political system decides to create flexible specialization in education may signal the rise of a new production system.

Yochai Benkler argues in *The Wealth of Networks* that network technology has allowed the emergence of a fourth transactional network that parallels the price system as its non-market counterpart.[29]

	Market	Non-Market
Decentralized	Price system	Social sharing and exchange
Centralized	Firms	Goverments
		Large non-profits

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[29] Benkler, Yochai. *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven, CN: Yale University Press, 2006.

Individuals carry out price-driven transactions in a highly decentralized environment. Yet, as economist Ronald Coase recognized three-quarters of a century ago, private firms compete externally as a part the market's price system, but internally they depend on managerial fiat to direct labor and other resources because it is too expensive to use the market for these allocations. Thus, production is centrally controlled in large private sector firms, governments and large non-profits because of the assumption that transaction costs are sufficiently high that markets can't supply what is necessary. Schools, for example, hire employees rather than bidding for their services on the open market each day. Imagine, the prospect of assembling a new teaching staff each morning as if school were a game of pickup basketball. Indeed, one of the most persistent problems high poverty schools face is the turnover in staff.

But in the growing world of peer production, individuals cooperate to create goods and services without the intervention of firms or government agencies, although they may be enabled by them. Social sharing is not new. Forms of exchange and reciprocity have characterized societies since the beginning. What's new is the scale and importance of social sharing. Goods and services produced through "commons-based peer production" are, in fact, in robust competition with those in the market sector. For example, Moodle, the open-source course and learning management software used at Claremont High, competes with Blackboard and textbook vendor systems.

In commons-based peer production, individual self-identification rather than management authority determines the division of labor in ventures, such as Moodle, Wikipedia, or the virtual reality system Second Life. As Benkler, whose engaging style has garnered him thousands of views on TED, explains, peer-production's voluntary, self-organizing work confounds conventional economics: "If you leave a fifty-dollar check on the table at the end of a dinner party at a friend's house, you do not increase the probability that you will be invited again. And if dinner is not intuitively obvious, think about sex."[30]

In one sense the people who toil with fixing source code for Moodle or correcting an article for Wikipedia are economic chumps, giving away what others charge for. But Benkler argues the contrary: that the intrinsic rewards of participation and affiliation are extremely strong, and that through usage of the common product the contributors are rewarded in material ways. Teachers have understood this for a long time, and networks of teachers have developed and shared ideas for decades.

Even corporations, such as IBM, which have been aggressive protectors of proprietary rights, have organized themselves around cultivating the commons and are profiting from it. Over the years 2000-2003, IBM's revenue from services related

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[30] Benkler, Yochai, "Open Source Economics," TED, April 16, 2008, (Accessed, Sept. 30, 2011) http://blog.ted.com/2008/04/16/yochai_benkler_1/

to the open-source Linux operating system outstripped that from licenses on the firm's intellectual property.

The Internet is different from other technologies because it passes the power of production and the ability to collaborate in production into the hands of individuals. It does not mean that all the capital necessary to process, store, and communicate information is under individual control. That is not necessary. But with a very modest investment, individuals gain the ability to access information, to take from it, rework it, and submit it back to the commons. [31]

This new networked-information economy contrasts and conflicts with the older industrial-information economy and sets up political battles between the two. Although there has always been an information economy, Benkler argues that it rapidly industrialized in the 19th Century. In 1840 James Gordon Bennett founded the *New York Herald* for $500, about $11,000 in today's money. With the advent of the mass circulation press, the capital requirement jumped to $2,500,000 current dollars in a decade, a trend of very high entry costs that characterizes the industrial-information economy.

The tendency toward high-entry costs and oligopoly has also characterized public education, not because the running of schools is a public monopoly, but because the provision of tests, pedagogy and curriculum has been the product of a very concentrated educational-industrial complex.

The high-entry wall of text and test developers has created a concentration of official curriculum. Text and curriculum developers are highly market sensitive, and they are responsive to the requirements of textbook approval bodies in the largest states, giving California, Texas, New York, and Florida a virtual lock on the market. Likewise, within these states, large school districts are particularly influential, but influential in an odd way. As school districts have increasingly fallen on hard times, they have dismantled their internal curriculum development departments—Los Angeles used to employ nearly 500 specialists—in favor of purchasing integrated packages of pedagogy, testing and staff development. Their buying choices guided the market. Thus, for all the political talk about preserving local control in education, the content of education has become increasingly centralized.

Until now.

That older economy is being challenged by peer production. In the last decade, the power of individual teachers, teacher collaboratives, and small developers to bring curriculum ideas into being has been radically increased because of social sharing and exchange. With the exception of CAVA, whose business model places it in the old informational economy, all of the illustrations of Learning 2.0 in the previous

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[31] Benkler, *Wealth of Networks,* p. 99.

section are built on teachers developing curriculum and remixing bits of curriculum material.
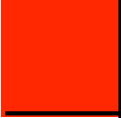
Teachers, such as those at High Tech High, build lessons and through the school's graduate school document project based learning. Teachers at School of One evaluate whether lessons are working for students and make or pick new material when things don't work. Moodle has created an avenue for peer production among teachers and also among students as have the various educational Wikis. The various aggregation sites are drawing these resources together.

Moreover, the decision point about curriculum adoption has effectively moved from state textbook committees and assistant superintendents of instruction to students, who are shopping on the web for material that teaches them. The open education resources movement has made tens of thousands of lessons, many of them from the nation's best universities, available for free. Online math lessons have propelled Salman Kahn to celebrity status while his Kahn Academy that contains 2,700 tutorials now draws 3.5 million hits a month. No state board approved it, no publisher sold it. Students, and more recently teachers, found it on the Internet, and its reputation spread largely by e-mail, Facebook and Twitter.

In Scotland, the government has invested in an intranet service, closed to outsiders, that connects students, teachers, schools and families throughout the country. The primary purpose of the system, called Glow, is to create a space for collaboration. Unlike the case in the United States, Scotland decided to develop its national curriculum through teacher-created lessons rather than programs from vendors. The country has made a $100 million investment in electronic infrastructure, connectivity and the software that hosts Glow.

Sometimes peer production can be both innovative and system challenging. Benkler illustrates this with a story about electronic voting machines, which were seen as the answer to the "hanging chads" problem with punch-card ballots in Florida and elsewhere that spawned the controversy about the 2000 presidential election.

In 2002, Diebold, the leading supplier of electronic voting machines, provided assurance that its new machines were accurate and secure, and these assurances were taken at face value by the mainstream media. But as Benkler notes, less trusting Internet activists decided to test the company's claims. They obtained and published the machine's specifications and code, and a whistleblower inside the company gave them e-mails that showed the operating codes for some of the machines had somehow been tampered with *after* they had been certified for use. Diebold attempted to suppress these findings, claiming the code and e-mails were protected by the Digital Millennium Copyright Act, but the volunteers—mostly university students—had made and distributed 50 copies, creating a network of information that was nearly impossible to suppress. The online discussion triggered an investigation by California's secretary of state, who set up an independent

investigation, and within a few months many of California's voting machines were decertified.

The Diebold story, and scores of other examples, illustrate a powerful production system at work. Students and other volunteers were able to uncover flaws in the Diebold system that professional journalists failed to see, in part because they were too trusting of corporate assurances, and in part because they had neither the knowledge or manpower to delve deeply into the matter. The volunteers had all the necessary tools in their hands. They did not need huge capital investments; all they needed was the ability to share their expertise and tools, which in this case included sharing the software to unlock Diebold's encrypted files.

Learning 2.0.net: A Modest Investment

The relevant policy question is whether California can feasibly take steps that use the new production system to bring Learning 2.0 into being and to use the new production technology to build the capacity of the state's education system. I believe it can.

California needs to invest in a learning infrastructure for students that use the new network production technology. Think of it as a combination of Facebook for school, the best computer game you ever saw, and a smart app for your mind. By thinking of the student as the end-user rather than designing educational products that will be attractive to a textbook adoption committee, the state can vastly open up learning to new participants, approaches and ideas.

Rather than designing a "one best system" as the developers of the early 20th Century learning model sought to do, adopt the notion of continuous improvement and redesign. Move away from the assumption that California can transition from early 20th Century learning to Learning 2.0 by adopting a new textbook series, by cabling schools, or selling them tablet computers by the truckload. Move away from the belief that "best practices" can be distilled into an educational pill for all to swallow or that every small innovation has to be scalable into a product that will work for the state's 6.5 million students. One of the design foundations of flexible specialization is breaking down complex processes into modules, as School of One does their math curriculum. The design idea is that modules can be combined in different ways to create customized products without starting from scratch with each one. Think Legos.

Learning 2.0.net would be available to students and teachers in large and small school districts around the state, but it would not operate by removing students from one jurisdiction to another, and therein lies the possibility for new political agreements. It creates winners, not losers.

The first design principle of Learning 2.0.net is to get data and learning tools in the hands of students under the (sometime) watchful eyes of their parents.

Second, build an open source system based on the experience of the users, expandable, fixable, and tweakable. Think Linux, the free open-source operating system, or Moodle, the open-source classroom and lesson system, rather than corporate and proprietary. These systems were built by thousands of willing hands, many from universities around the world who engaged in peer production because they simply loved the task. California abounds with these resources.

Third, build systems plural, modular not monolithic, scalable not singular.

Given these design principles, Learning 2.0.net would be built around three sub systems: information, learning experiences and testing.

Information

Think of it as lights on the pathway to college and career. Currently, the pathway is not well lit, and it's not level either. Professional-class families can illuminate the path to college for their children through the lived experience of parents. But for poor and working class families there are hidden rocks and potholes. By when should a child be redesignated as English fluent to have a good chance of getting into college? Why are class placement tests at a community college important?

At a minimum, students and their parents ought to have online access to reliable information about where they are on a pathway, an educational GPS function. They shouldn't have to go to school and ask, find a piece of paper that was mailed from the state, or try to interpret the meaning of archaic numbers or percentages. They should know what testing hurdles they face and how to prepare for them. They should know the options that are available in different schools, tutoring and support.
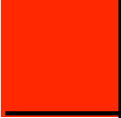
Learning

The second part of Learning 2.0.net would offer a variety of learning experiences, or access to them.

The number of iPhone and iPad apps, many free, grows almost hourly. I find an interesting one almost weekly. It's possible to dissect a rat electronically with nearly the same precision as a knife, and without the formaldehyde smell or the ultimate sacrifice on the part of the rat.

In fact, there is so much learning material on the Internet, that it is difficult to sort through and evaluate it all. There are great lectures and not-so-good ones. There are wonderful applications and cranky ones that don't work or which are overpriced. Learning 2.0.net should function as an aggregator, in a way that is somewhat analogous to Google's "news" application.

Learning 2.0.net could display the state standards, and eventually those of the nation's Common Core, as if standards were scout merit badges and the learning applications were ways to achieve them. That way, students could know what they need to know and how to get there. Even young students—using material from

Leapfrog, for example—obtain an accurate assessment of what they need to do and self-direct.

Also, Learning 2.0.net can assist the development of particularly sophisticated applications, social or scientific simulations, for example, but even this material is rapidly being developed by universities, foundations and advocates for particular learning modalities. For example, http://pbl-online.org/, provides fully developed examples of project based learning as does Connect Ed for projects and Linked Learning (http://www.connectedcalifornia.org/). Their resources include a fully developed template for the crime scene project that was described earlier, among many others.[32]

Using the Internet-fueled capacity for network collaboration, the capacity for creating lessons, experiments and projects passes to teachers and arguably to students. Wikipedia projects in education are multiplying, the product of individual and cooperative initiative, largely unstructured by state or school.[33] Minnesota teachers (and others in many locations) are writing their own textbooks or radically supplementing the text, as did Cheryl Fiello at Claremont High School.[34] The Flat Classroom Project, begun by two teachers—one in Los Angeles, the other in China—joins students and teachers from around the world, both virtually and in person.[35] Curriki, begun by former Sun Microsystems chairman Scott McNealy, claims more than 5.4 million users for its lesson and curriculum sharing site.[36]

Gaining Credit

Third, Learning 2.0.net would allow students to take tests and get credit for learning.

For a century the two most important qualifications for passing a course have been the date of manufacture of the student and the number of hours the student's bottom has been in a classroom chair. Access to learning was largely a function of birth date, and credit for a course was a function of class attendance and participation. Students took lots of tests generated outside the classroom, but with the exception of the SAT, which is a gateway to college, few of the tests provided substantive rewards for students.

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[32] http://www.connectedcalifornia.org/downloads/curriculum/CSI_CA.pdf (Accessed, Nov. 28, 2011).

[33] http://en.wikipedia.org/wiki/Wikipedia:School_and_university_projects (Accessed, Nov. 28, 2011).

[34] Associated Press. 2011. Minn. Teachers Write Own Online Textbooks. http://www.edweek.org/dd/articles/2011/11/06/467399mnonlinetextbooks_ap.html (accessed Nov. 28, 2011).

[35] http://www.flatclassroomproject.org/About (Accessed, Nov. 28, 2011).

[36] http://www.curriki.org/?bc= (Accessed, Nov. 28, 2011).

Learning 2.0.net would change that. Students could take tests when they were ready, could pass courses when they were ready, could take tests as formative feedback.
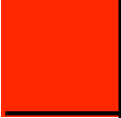
Unbundling teaching and testing also allows the whole education system to become more productive. If the financial rewards for school systems were correctly managed, it might also incentivize schools and districts to accelerate learning. And instead of drawing students away from substantive learning, substantive tests would motivate students and place the teacher in the position of a supportive tutor and coach to help them reach their goals.

The Politics of Learning 2.0.net

Learning 2.0.net would change the politics of education in California by changing the way students interact with the tools of learning. By changing the way students and teachers work, it would activate new interests in education, and reshape the interests of well-established parties, such as teacher unions, parents and school districts.

Learning 2.0.net would change politics differently than governance intervention, like charter schools, or the operations such as the L.A. (mayor's) Partnership, or Pilot Schools. The logic of these interventions is that innovation and change is best advanced through separation, removing the innovation from the deadening influences of the existing educational bureaucracy. Separation is a time-tested innovation technique, and for decades management students have read about the "Skunkworks," where the corporate mavericks from Lockheed gathered together to develop fighter planes. But the separation technique always has problems infusing change back into host organizations. Indeed, the history of education reform is formed from a series of cases in which schools changed reform, rather than the other way around.

The grammar of schooling persists. Tinker with that and people think you are weird, experimental and illegitimate. If you are an aspiring school administrator, they will not let your career advance. If you are a teacher, your colleagues will isolate you, unless of course you work very quietly and ultimately alone. If you are a teacher union leader, you will be marginalized. As Cuban writes: "the bedrock of schooling remains an organizational structure introduced in the mid-19th century . . . . Advances in new technologies have hardly made a dent in this permanent structure .

. . . Until the age-graded school and funding mechanisms change, the use of new technologies for classroom instruction will remain peripheral."[37]

The currently popular separation techniques also involve changing the authority structure of educational organizations. Although there are exceptions, such as Avalon where teachers run the school, most governance interventions involve a form of autocracy: a political heavyweight connected to a "my way or the highway" management style.

Changing the authority structure creates sustained political resistance. There are real political interests involved. Changing the authority structure, as in the case of Chicago or New York or Washington, DC suppresses the opposition, but it does not eliminate it. Indeed, it activates it.

Learning 2.0.net would change schools using a different political logic. Rather than facing the frustrations of attempting to revolutionize education by dismantling the existing interests, recognize and invest in networks of teachers, students, entrepreneurs and thought leaders that "operate through, around, across, and outside traditional boundaries."[38]

Rearranging the Interests

Allowing individual students and teachers to access, adopt and adapt Learning 2.0.net content and services changes the politics of interest groups. It would activate student and parent expectations of schooling. Particularly in smaller districts these expectations can change school district behavior and policies. In Claremont, for example, parents began to expect that they would have access to their children's curriculum, be able to view the lessons they were working on, and this, in turn helped drive the use of Moodle in the high school.

It would allow teachers to have field trials of new ways of arranging their work without frontally attacking the idea of a class or student-teacher ratios. Learning 2.0.net is not coercive. No state agency or district would demand its use as a matter of system design. Learning 2.0.net's growth would come about through practice adoption rather than mandate. At the same time, teachers would not need to ask permission to use its resources, any more than they ask permission to use the Internet.

Thus, changes in practice could follow a technological or product-adoption curve rather than the more normal process in education in which practices are piloted with

[37] Terry Moe, Larry Cuban, and John Chubb, "Virtual Schools: Will education technology change the role of the teacher and the nature of learning?" *Education Next*, Winter 2009, vol. 9, no. 1, http://educationnext.org/virtual-schools/.

[38] Davidson, Cathy N., and David Theo Goldberg. *The Future of Thinking: Learning in a Digital Age*. Cambridge, MA: MIT Press, 2010, p. 15.

a small group of enthusiastic teachers and then mandated for everyone else. There have always been teachers who grooved on technology and who would follow it simply because they liked playing with computers, writing applications or just feeling cool because they perceived of themselves as being in the forefront. Computer Using Educators, for example, has been in existence for more than 30 years, when the devotees were staring at the green screens of Apple IIs. But because the technology-adoption curve previously ran through school districts, requiring capital investment, lots of cabling and wiring, curriculum committees and the whole apparatus of public school, the enthusiasm of technological early adopters often did not spread.
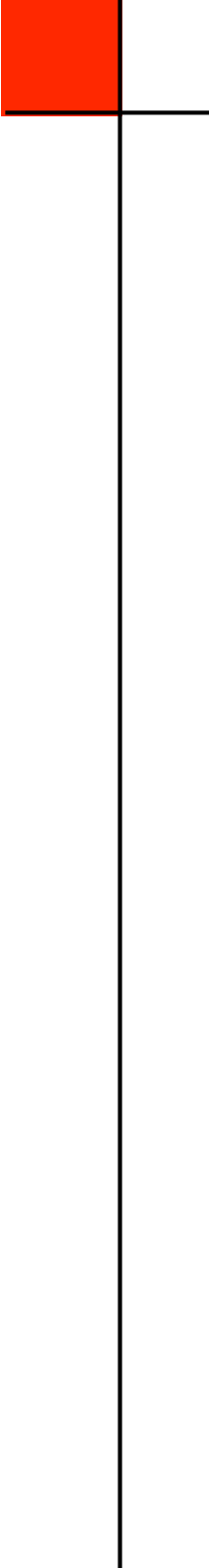
Sometimes it did not spread because of overt resistance, but more often it failed to spread because the technology in question was not very efficacious or because it was so clunky that most teachers didn't want to use it. But gradual adoption and the platform afforded by the Internet create a different environment.

Teacher interest in using Learning 2.0.net would be incentivized in part because it allows them to teach using modalities that their students, the digital natives, already know and understand. It would capture interactions between students and technology and turn them into genuinely educative experiences. Rather than fight student use of technology—check those cell phones at the office—Learning 2.0.net would create the opportunity for teachers to embrace them. In addition, Learning 2.0.net would foster teachers collaborating, working together to develop Wikis, greatly enhancing the capacity for professional learning communities, which educators have sought for decades, largely unsuccessfully.

Thus, teachers would become producers of educational resources rather than simply being viewed—however inaccurately—as simply deliverers of instruction. Historically, teacher–led changes have not persisted in the face of curriculum and tests provided by vendors. New technologies offer an important opportunity to the teaching profession, and coincidentally to those who represent and advocate for them, including their unions and growing networks of teachers.   The playing field is not level, but it is less tilted.

Teacher adoption can lead schools and unions. Putting teachers in the education production business rather than as deliverers of instruction changes the relationship between them and their unions. Learning 2.0.net allows teacher unions and school districts to embrace technology without forfeiting the students, the revenue they bring to a school district, or the teacher jobs that revenue allows. Students would remain enrolled in their home school and district.

If the policy aim of the state is to spread new learning technologies, then it needs to hold existing schools harmless, thus allowing the new modes of learning to spread without penalty to existing schools and districts. Florida's online academy provides an example. In its early days, a student who took courses at the state's virtual academy also generated attendance-based revenue for his or her school district. The districts did not oppose the use of blended and online learning then, but when

the rules changed so that enrollment in the virtual academy reduced revenue to the district, the traditional brick and mortar schools became oppositional. Eventually the economics of blended learning will have to be rationalized, but this process can proceed gradually, a bit like the growth of ATM machines in banks. The whole system needs the infusion of learning technology in the hands of students and their teachers, and if technology is poised only as a substitution of computers (and the capital backing them) for teacher labor, then existing interests will resist. There is no particular reason to have this fight. It is far better to allow teachers and students to develop technology applications and gradually change the nature of a class in school, how schools are staffed, and the mix of labor and technology. The gradual nature of this change helps create the laboratory that is needed to understand how Learning 2.0 works best.

Activating Needed Laboratories

Instead of a standard design, California needs many laboratories. Learning 2.0 is still in the experimental stage. All the examples are small, the D(evelopment) part of R&D. Comparatively, they are where Bill (Hewlett) and Dave (Packard) were in 1939 when they were tinkering with technology in the garage. It is far too early to impose a standard design or to build a "one best system," as the Administrative Progressives did with Learning 1.0. It would be counterproductive and may never be necessary.

Learning 2.0.net changes the politics of education by empowering its end users and thus encouraging diversity. By changing the unit of adoption from state textbook committees, and assistant superintendents of instruction to students and teachers, the technology market is creating greater variety and providing learning tools that people want to use. The system also provides instant feedback and criticism. The Apple App Store, for example, includes reviewers' comments, and there are many independent review sites.[39]

Several states and the U.S. Department of Education are attempting to create clearinghouses of online applications. In November 2011, the U.S. departments of Education and Defense officially launched a national registry or clearinghouse so that educators can easily find relevant information for their curricula. Each department is contributing $1.3 million toward the effort. At the same time, the Public Broadcasting System announced a new platform for educational content,

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[39] There is an ongoing effort to police reviews to eliminate overly positive reviews from employees, friends, and paid respondents from inflating an application's ratings and from competitors giving it low ratings. See: Bertolucci, Jeff. 2009. Can You Trust Itunes App Store Reviews?
http://www.pcworld.com/article/161406/can_you_trust_itunes_app_store_reviews.html
(accessed November 29, 2011).

some of which will be linked to the national registry. Some of the PBS content carries a fee for schools that use it, but access is free for individual educators.[40]

Several state, proprietary and non-profit organizations already exist to provide links to software, bundle it around curriculum ideas and standards, and frequently these organizations also evaluate the software. Some rank programs using experts, such as curriculum specialists; others are more end-user oriented relying on teachers.[41] For example, Sophia operates only on the basis of contributed lesson "packets" and user evaluation of them.[42]

Because Learning 2.0.net builds on student and teacher experience and their informed choices, it has the capacity to provide a great deal more feedback than does the current system.   As for lesson evaluation, it would allow educators to learn more from existing larger scale experiments.

In addition to the ability of day-to-day public school instruction to serve as a laboratory, public policy in California has established two potential education laboratories that should be better used. Charter schools, in their original intention, were supposed to be Petri dishes of innovations that would be transferred to district-run schools. Pilot schools, which are essentially in-district charters, are being spawned in the Los Angeles Unified School District and could work elsewhere as autonomous schools where teachers and educators remain district employees. They have an experimental capacity similar to charters, and each goes through an explicit design phase before being approved. An older, largely abandoned, tradition of university-based laboratory schools could also be revived to create applications for Learning 2.0.net.

The state should treat charters, pilot schools and university-related schools as laboratories of learning rather than experiments in governance. Learning experiments should be explicit, a part of the design and application process for such schools. The requirement for pedagogical experimentation should apply particularly to statewide-benefit charters, those which are granted the ability to work across school-district boundaries. And the state should augment charter and Pilot school funding to allow careful documentation. Universities should be able to modify their teacher- and administrator-education programs to incorporate laboratory schools, and they should get added support to do so.

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[40] Quillen, Ian. 2011. Ed Launches Registry; Microsoft Takes Over Teach. http://blogs.edweek.org/edweek/DigitalEducation/2011/11/national_learning_registry_off.html (accessed Nov. 30, 2011).

[41] Quillen, Ian. 2011. Quality Content in Demand as Multimedia Expands. http://www.edweek.org/ew/articles/2011/06/15/35mm-quality.h30.html?r=1874195470 (accessed Nov. 30, 2011).

[42] http://www.sophia.org/ (accessed Dec. 5, 2011).

Creating a Public Interest in the Commons

Learning 2.0.net confronts the clash between the web aphorism, "information wants to be free," and what Benkler calls "a second enclosure movement": a concerted effort to shape law and institutions in order to help proprietary models of information production.[43] The problem is not solely with profit seeking, although there is plenty of that. There is a great deal of legal tradition that favors the assignment of property rights to individuals, regardless of how hard they are to sort out, and hostile to the notion of common production.

As James Brink, who reviewed Benkler's book *The Wealth of Networks*, wrote:

> *The West is engaged in an escalating culture war. The battlegrounds are the courts, the legislatures, international bodies, local communities, and distant countries that individually may not have much power to affect the outcome though they do have a vital interest in who wins. The war is global—and it is one that has little to do with gay marriage, abortion, terrorism, Darwinism, or religion. It is in one sense, a war going on above our heads, as it is largely concerned with law and policy, and society and property. In another sense, it is very much a war in the trenches, as it affects our ability to choose how we will live and interact with each other as consumers, creators and citizens.[44]*

School districts, along with colleges and universities, have a very strong interest in creating a workable commons. Universities, more than school districts, have a history of cooperative enterprise, the free sharing of ideas and content among scholars. But they also have a history of claiming rights. Patent and license income is important to many leading research universities, just as it used to be to leading school districts, which in the somewhat distant past developed and sold curriculum to other schools. (Ironically, the current leading school district to provide curriculum is the Singapore Ministry of Education, which trades on the high test scores of its students to sell its math curriculum worldwide.)

The state has a very strong public interest in preserving the open-source commons and not allowing corporate interests to monopolize the intellectual and pedagogical core of its educational system. Corporate interests will use the force of law to strike back. Public schools are particularly sensitive to the problems of copyright, and corporations such as Disney have been particularly aggressive at pressing their protections; for example, when a teacher shows a cartoon in class. (Which is

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[43] Benkler, *Wealth of Networks,* p. 381.

[44] Brink, James. "Book Review: Yochai Benkler, *the Wealth of Networks*." *German Law Journal* 7 (2006): p. 853.

probably not very good use of class time in the first place, but that's beside the point.)

Unfortunately, existing interest groups are forming battle lines in the wrong places, primarily around the regulations regarding technology use. The more fundamental interest is *who builds Learning 2.0*?

At issue is whether teachers and school administrators are to be cast primarily as industrial era factory workers, whose job it is to oversee the flow of externally created learning technology; or are they primarily educational artisans and craft workers, whose job it is to choose among available tools, adapt them to specific needs and build new ones. A powerful realignment of interests will take place when teacher organizations—from unions to teacher disciplinary organizations, such as those in English and math—organize around advancing teacher capacity to design lessons and control the content of their own work.
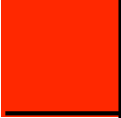
Protecting the commons also requires public funding of computer access. It means including time in teacher work weeks for their participation. It means developing technology that teachers actually want to use. It means incentivizing those teachers who are leaders in development. The state also forwards its interests by creating design standards, in the same way that Apple creates standards for the applications one can buy for its phones and tablet devices. By creating design standards and learning modules, the state will allow teachers and many others to combine bits and pieces of instruction and teaching ideas from different sources and prevent the vendor's monopolistic practice of creating what is called coherence as a way of increasing market share.

Attaching the School Finance Issue to System Capacity and Productivity

Learning 2.0.net would change the school finance debate. In recent decades, policy debates over school finance have revolved around whether students are being treated equitably or whether the state is providing an adequate education, as most state constitutions, including California's, require. Learning 2.0.net would provide a way to link resources with outcomes and thus promote productivity.[45]

It would do this by allowing students to take tests and get credit when they are ready rather than when they had completed a prescribed number of days sitting in class. By breaking the linkage between attendance, the credit that students gets, and the dollars a school district receives. The testing capacity in Learning 2.0.net would spur public policy to modify attendance-based financing and create incentives for new forms of learning.

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[45] Jacob E. Adams, Jr., (ed.) *Smart Money: Using Educational Resources to Accomplish Ambitious Learning Goals*. Cambridge, MA: Harvard Educational Press, 2010.

Under Learning 1.0, schools adopted age-graded, batch-processed schooling because it was the cheapest, most efficient way of creating a system of mass education, not because it was the best way of learning. Those who designed the system had to define what they thought was "normal" human development and create a curriculum around it.

There were only two ways to gain efficiency in this system. One was to create bigger batches, larger class sizes; and the second was to train and develop teachers capable of getting better results from students.

The major problem with the system has always been that students aren't very batchy. The more "not normal" you were as a student, the more difficulty you had with the system. If your learning style, speed at picking up a new concept or interests were different, school was either boring or terrifying. Thus, despite the persistence of an early 20th Century mode of production, much of the craft of teaching involves finding ways to work around the edges of batch processing so that students don't fall behind the norm or are appropriately challenged to go beyond it.

A contemporary classroom often contains spaces for individuals or groups of students to work while the teacher presents a lesson to the rest of the class. Lessons are structured so that students can work together and the teacher can check to see if a particular pupil understands what's being taught. Often different learning modalities are brought in: manipulatives and counting blocks for math, physical models in physics, videos and artifacts in history.

This process of building accommodations for learning styles, tastes and speed around the edges of the batch processing system slowly created an expensive and complex education production system. Indeed, most of the increases in education expenses over the last 40 years are found in compensatory and special education.

The limits to batch processing can be seen in the ways we spend the education dollar. Richard Rothstein and his colleagues have been tracking education spending for more than three decades using records from a sample of school districts around the country. The share of the total per-pupil spending that went to regular classrooms *decreased* by nearly 25 percent over the years 1967-2005, while the share that went to special education increased by 17.3 percent. In Los Angeles Unified, one of the districts Rothstein tracked, the regular classroom share decreased by 41 percent.[46]

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[46] Alonso, Juan Diego, and Richard Rothstein. *Where Has the Money Been Going: A Preliminary Update*. *Epi Briefing Paper 281*. Washington, DC: Economic Policy Institute, 2010. Rothstein, Richard. *Where's the Money Going? Changes in the Level and Composition of Education Spending, 1991-1996*. Washington, D.C.: Economic Policy Institute, 1996.

This is not to say that inflation-corrected resources in regular classrooms decreased. Even by Rothstein's inflation index of service costs, which has risen more rapidly than the Consumer Price Index, real per-pupil spending growth went up by 20 percent in L.A. In that respect, education is like other labor-intensive service industries following a pattern of production expenses noted by economist William Baumol half a century ago.[47] The production economics pushes the cost of everything up, but in order to address limitations in the classroom-based batch process model, public policy changed the ingredients of the education recipe making it more expensive.

While there are predictions of a fiscal windfall when the economy recovers, it is unrealistic to believe that the state will ever get to the point of lowering class size and increasing compensatory services sufficiently to accommodate the kind of customization needed for drastically improved learning. Indeed, one research report from former Gov. Arnold Swarzennegger's financial task force estimated that it would take as much as $1.5-trillion to bring the schools up to the capacity of bringing test scores up to the state standard in all schools.[48]

Thus, it is important to develop the capacity to efficiently replace batch processed education. Learning 2.0.net is a beginning.

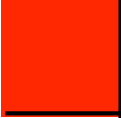## Opening the Human Resources Issue in an Iterative Way

Although Learning 2.0.net is built and delivered with Internet technology, at the core is it is much less about computers than it is about changing the way people work. It provides a platform for students to more fully engage their education and for teachers to create better jobs for themselves.

The humanness of the changes in learning is lost on many enthusiasts of change, and thus it was refreshing to read a comment from Nick Ehrmann who started Blue Engine, an organization that recruits and provides college-trained tutors for high-need public schools. Ehrmann framed the problem this way after observing a New Schools Venture Fund gathering in 2011:

New technologies, from gaming to personalized instruction, to social networking and online tutorials hold extraordinary promise, but equal attention—if not more—should be directed to the human capital implications required for any "innovation" to increase student achievement. New technologies are not solutions….

[47] Hill, Paul, and Marguerite Roza. *Curing Baumol's Disease: In Search of Productivity Gains in K-12 Schooling*. Seattle: Center for Reinventing Public Education, University of Washington, 2010.

[48] Imazeki, Jennifer. *Assessing the Costs of K-12 Education in California*. San Diego: Department of Economics, San Diego State University, 2006.

Two challenges come immediately to mind on the human capital front. The first is the impact of new technologies on teachers. Do they want them? Will they use them? Can we use technology to make the job of teaching more sustainable by helping teachers teach and spend less time on busywork….As a former teacher who used a pencil-and-paper grading book (in the 21st Century) and whose row of shiny Mac Pro desktop computers sat idle at the back of the room for the year (I didn't know what I should be doing with them), I would like to see the tech evangelists grapple as much with the behavioral economics—the science behind why people do what they do—as with the gadgetry behind the next big product.

The second challenge will involve rethinking how human capital is deployed in schools….

If the goal is to accelerate academic performance for all—or, more realistically, to achieve dramatically greater good for greater numbers—then we must find ways of moving beyond the current, industrial 30:1 student-teacher ratio in brick and mortar classrooms. This is a laudable goal. But at the NewSchools Summit…, the answer seemed to be: let's ramp up our use of technology schools, let's align private-sector incentives with market opportunities in K-12, and boom, learning outcomes will spike nationwide. In most sessions, there was little mention of actual teachers, teacher training, professional development and the political will required for our new technologies to benefit real kids in real districts in real classrooms.

Technology and human capital are not opposing concepts, but we must do more to integrate the conversation. Only then will students benefit from the "promise of technology" that we've been promising for so long.[49]

Learning 2.0.net would allow public policy to approach the human issues in an iterative way, using experience rather than ideology to redesign work. All the existing and emerging interests see the challenges and opportunities posed by different forms of creating learning. For example, blended learning or the organization of learning in ways other than traditional classes obsolesces standard class size limitations, indeed the whole definition of a class. Monitoring online instruction probably doesn't require the skill set of a certified teacher. But no one yet knows all the contours of a teacher's job in this new environment; much less what's fair and just. We do know that getting from here to there will require a lot more flexibility and experimentation than the current system generally provides.

Learning 2.0.net would open up the possibility of experimentation on a micro-scale: a few students, a few teachers at a time. Eventually, these will be built into changes in work rules and compensation. There will certainly be disagreements, maybe even strikes, as there have been in other occupations where new work technologies have

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[49] http://www.newschools.org/blog/nick-ehrmanns-rethinking-human-capital-in-technology-based-education (Accessed January 9, 2012).

taken place. Medical practice, for example, wrestles continually with the boundary lines of occupations: the relationship of nurses to physicians and medical assistants.

Teacher unions, as is the case with unions in other occupations, have been historically protective of existing work rule relationships, blocking the use of technology. However, these blockages have sometimes been less real than they appear. For example, a committee report by the California Federation of Teachers has been cited to illustrate the union's unreasonable opposition to online instruction: "No faculty member shall be required to teach a course using distance technology."[50] But in reality hundreds of school and community-college teachers use online instruction every day, and many of them have been quite inventive about developing distance learning.

What we conventionally think of as *good work* may need to be amended. Teachers flock to work environments where they do things that to a conventional union, indeed to a conventional management perspective, seem non-rational. Teachers at High Tech High, for example, have no job security. But they get tremendous ownership of their own work. The school is fiercely protective of the basic belief that it is teachers, not curriculum developers, who develop what is to be taught. If you are an inventive teacher, you get to live your dream at HTH, and hundreds of applicants line up for each opening. The story is similar at Avalon, where the whole notion of a hierarchy is called into question. There, teachers critique each other; they fire each other for poor performance, and they also run the school in one of the most developed examples of a professional learning community in the country. But all the Learning 2.0 examples did not all come from chartered or otherwise differently governed schools. School of One exists within the New York public schools and the conventional union contract. Teachers at the New Tech schools in Los Angeles and of the Pilot Schools there are proud members of United Teachers Los Angeles. Learning 2.0 will surely transform teacher unionism, and it will deeply challenge its current form. Historically, when the technology of work changes or the nature of work organization changes, the unions that represent workers under the old production system die. Teacher unions will need to think and act in dramatically out-of-the-box ways if they are to survive the revolution in the production of learning.[51]

Ultimately, unions resist the changes in work that new modes of learning bring at their own peril. Historically, unions have not fared well when the basic technology of work changes. In California's at least semi-friendly political environment, teacher unions have the chance to get ahead of the curve of teaching and learning innovation. If they fail, and most pedagogical innovation takes place outside of the realm of district-run unionized teachers, the attractiveness of these schools as

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[50] Izumi, Lance T., and Vicki E. Murray. *Short-Circuited: The Challenges Facing the Online Revolution in California*. San Francisco: Pacific Research Institute, 2010.

[51] Kerchner, Charles Taylor. 2009. Things That Go Bump in the Night. http://charlestkerchner.com/cr/journart.php?pid=53 (accessed November 30, 2011).

workplaces is likely to diminish rapidly along with the size of the unionized sector of public education.

Drawing on the examples of Learning 2.0 experiments, it is apparent that in each of the schools the nature of teaching work changed. Teachers did not do what they had done in the past or what they may have learned that teaching was about. This causes tension and a tendency toward reverting to the known and comfortable. John Danner at Rocketship hires Teach for America members precisely because they had not been acculturated in conventional schools, and thus did not have to unlearn habits of practice. Joel Rose remarked that some of the teachers in School of One schools missed the theater of lecturing. CAVA teachers reported a difficult transition from teaching classes to working with parents, who were the day-to-day presenters of lessons for home-educated students. Carrie Bakken of Avalon School noted the tendency in project-based schools to revert to classroom teaching when projects don't provide the level of achievement necessary. Direct teaching is what the faculty knows, and it becomes the default solution.

In most of the locations there is a new combination of human resources. For the teaching work force this means more differentiation. At Rocketship, each school has an academic dean who handles professional development and supervision of instruction. Rocketship also uses community workers to work students through the scripted parts of the learning process, so that teachers can work on the higher order skills and projects. At Claremont High School, one teacher became the technology evangelist, the person charged with helping teachers adopt and use Moodle. She was not the techie, who ran the network and saw that the hardware was working, but the teacher who built a transition from conventional classroom organization to online connections.

Also, each of the examples had built in professional development. Learning to do schooling was something that people did at school, with colleagues, and as a part of their regular jobs. Schedules changed to make this possible. At Avalon, teachers meet several times a week.

Finally, the role of parents changed, in at least some of the schools. Rocketship has a parent board and parent expectations that students will do well. At Avalon, parents sign off on each project their students engage and frequently they serve as official resources for the project. Engagement of parents in the learning process also changes the adoption of new ideas and the political forces involved.

Allowing Existing Schools To Be Winners

The research that preceded this policy analysis began with the observation that education reform, particularly in Los Angeles but generally across the nation, was in

a state of *permanent crisis.* The waves of education reform had failed to produce an institutional turning point or a big winner, either politically or educationally.[52]

In the current politics of education, the political divide separates people who call themselves *reformers* from those who work within public education. And the deck seems stacked against conventional public schools. Charters get deregulation; school districts get interventions and penalties. But if charters need "space" to innovate, why is not the same need for flexibility and experimentation applied to the school districts charged with the education of the great majority of our students? Reformers can denigrate the test scores of district-run schools, but they defend charters and alternatives as "useful experiments" or schools that have "different goals."

Conventional wisdom holds that old organizations can't design new work. Thus, the way forward is to create new organizations, separate from conventional school districts and schools. Most of the organizations profiled here fall into that category, but as advocates of online learning are beginning to realize it is necessary to have a change in technology that involves district schools. Corporations see schools as a market to be captured: "When it comes to K through 12 education, we see a $500 billion sector in the U.S. alone that is waiting desperately to be transformed by big breakthroughs that extend the reach of great teaching," said News Corporation Chairman and CEO, Rupert Murdoch, after purchasing Wireless Generation for $360 million.[53] Learning 2.0.net is a counter-strategy that builds the capacity of the public sector to transform itself in partnership with commercial and non-profit interests.

Learning 2.0.net does not fully answer the question of the creating winners among school districts, but it creates the capacity to do so and offers the right incentives. Students in existing school districts who study via Learning 2.0.net are still enrolled in their home schools. Their school districts, and the teachers in them still get paid. The technology is freely available to their students. What they do with it spells out the difference between winning and losing.

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[52] See: Mark Blyth, "Studying Educational Systems with the Tools of Institutional Theory," p. 153-168, in *The Transformation of Great American School Districts: How Big Cities are Reshaping Public Education*, ed. William Boyd, Charles Kerchner, and Mark Blyth (Cambridge, MA: Harvard Education Press, 2008).

[53] http://www.newscorp.com/news/news_464.html (Accessed January 3, 2012).