Transforming America's Education Through Innovation and Technology

VOL. 25, NO. 4

AUGUST 16–21, 2010

DIRECTOR:
Dick Clark

THE ASPEN INSTITUTE

Washington, DC

This project was funded by Carnegie Corporation of New York. The statements made and views expressed are solely the responsibility of the authors.

Copyright © 2010 by The Aspen Institute

The Aspen Institute
One Dupont Circle, NW
Washington, DC 20036-1133
Published in the United States of America
in 2010 by The Aspen Institute

All rights reserved
Printed in the United States of America
ISBN: 0-89843-530-7
1795/CP/BK

Table of Contents

Rapporteur's Report

Carol Copple, Ph.D.
Rapporteur

Transforming America's Education Through Innovation was the theme of the 2010 conference sponsored by The Aspen Institute Congressional Program, held August 16-21 in British Columbia, Canada. The meeting was the seventeenth in a series that examines policy options for promoting the education and well-being of American youth, and thus the well-being of the nation. A bipartisan group of 16 Members of Congress participated, together with five invited experts with relevant knowledge and experience. The Congressional Program series is not intended to yield a consensus statement of recommended policy directions. Rather, the aim is to help inform policy makers and facilitate the search for common ground on which effective American legislative policy must rest. The 2010 Congressional Program conference examined key teaching and learning challenges in today's schools for which technology and innovation offer new solutions.

Urgent necessity of education progress

The global, technological economy today demands workers with unprecedented levels of knowledge and skills. Yet skill levels in the American workforce have flatlined, while many other countries have advanced rapidly and outstripped the United States in production of college graduates and skilled workers. At risk is the economic future of today's youth as well as the health of the economy and society.

Behind the looming deficiency of skilled workers is the fact that the United States is not managing to educate its youth to the higher levels that are now necessary. Dropout rates are alarmingly high, and students who do graduate often lack even the rudimentary skills and knowledge to cope with the demands of post-secondary education and work.

These disturbing realities—and a commitment to equity—led to the No Child Left Behind (NCLB) legislation of 2001, which made the education of all children a national imperative. Nearly a decade has passed since NCLB was enacted and still far too many schools are falling short. A major reason is that while the law required that states hold districts and schools accountable for getting all students to "proficient" achievement levels, it allowed them to adopt their own definitions of proficiency. The result has been a profusion of different standards, proficiency definitions, and tests. And most state assessments target a basic level far below the level of skills needed in the present economy, which include problem solving, reasoning, analysis, and applying knowledge in real situations.

The time is ripe

With respect to these issues, the nation is now at a juncture that holds great opportunity for change. Essential pieces of the puzzle are in place:

- Accountability for student outcomes from NCLB provides the leverage needed for reform;
- The recently released Common Core Standards—designed to be fewer, clearer, and higher—will provide curricular coherence and emphasis on 21st century skills;
- With the common standards as a basis, there is now movement toward improved assessments;
- The Race to the Top competition has challenged states to develop comprehensive plans that include crucial elements such as teacher support and accountability;
- Technology is available to transform teaching, learning, and assessment; and
- An evidence base exists for what low-performing schools need in order to turn around.

The tight economy and reduced state revenues are producing serious fiscal constraints. Yet a great many policy makers, employers, and other citizens are well aware of the urgent need to improve education in order to foster long-term economic stability. The economic climate necessitates making careful judgments and getting the most out of every dollar spent. The fact remains that this is a propitious time for substantive change in American education.

Looking to technology for new solutions

Technology continually brings fresh possibilities to the daily lives and work of Americans. For youth, the momentum of technological change is particularly rapid and strong. We can and should leverage this power in education. Technology can be invaluable in meeting the education challenges that face us—in providing engaging, effective learning experiences, rich content, meaningful assessment—and doing so affordably. In the decade ahead, technology-based systems can be pivotal in improving student learning and generating data for continuous improvement of education. Further, technology can help us to provide principals and teachers with higher-quality professional preparation and learning throughout their careers and to give them substantially greater opportunities to collaborate. In other words, technology is not a mere fad or buzzword but a critical tool that must be integrated throughout all dimensions of education to improve learning outcomes and keep costs down. Federal leadership and funding for research and development will help to realize technology's vast potential for improving teaching, learning, and assessment.

Invigorating teaching and learning

What lies behind the persistent international superiority of many countries in educational achievement relative to the United States? A variety of factors contribute, but the most striking feature across high-achieving nations is coherence and consistency in curriculum, which stem from a national curricular framework or set of standards. To propel education reform, U.S. policy makers at the state and federal level must put such consistency and coherence at the heart of improvement efforts, and they have begun to do so. Governors and state commissioners of education from across the country committed to a state-led process to develop a common core of standards in English language arts and mathematics for grades K-12 that are internationally benchmarked, aligned with work and post-secondary education expectations, and inclusive of the higher-order skills that students need. Now the standards have been adopted by the majority of states, and a greater measure of curricular consistency across states is at hand.

As for the teaching enterprise, classroom teachers in the U.S. typically do a great deal of whole-group instruction, which tends to mean teaching not to the most advanced or the struggling students but to the middle of the pack. To reach all students requires far greater differentiation of instruction and, in this effort, technology can be invaluable. It allows for enormous flexibility and can provide a nuanced

picture of each student's learning. Moreover, technology allows students to take a greater role in controlling the nature and pace of their own learning. A core set of standards-based concepts and competencies provides the basis of what all students should learn, and strategic use of technology gives educators and students far more options for structuring learning in different ways. Students can work in small groups, large groups, and on their own, with work tailored to individual goals, needs, interests, and prior experience of each learner.

With more extensive use of technology, teachers will be connected to a rich array of learning data and tools for employing the data. And instead of only getting end-of-year scores, which are useless for informing instruction, teachers will be much closer to their students' work and have in their hands far richer data on individual student learning in near real-time. Thus teachers will know where their students are with respect to learning goals, strengths, and weaknesses and be better able to support student learning both inside and outside school.

Assessment for the 21st century

In education one axiom holds up again and again: Whatever is tested gets taught. This is especially true with high-stakes assessment. When students are assessed in only two or three subjects, the curriculum narrows to these subjects. And when students are tested on basic skills and information by multiple choice tests, the curriculum focuses on these skills and facts. Because such assessment does not invite students to deliberate, construct arguments, apply knowledge, or think deeply, these abilities get little emphasis in most classrooms. In most high-achieving nations, by contrast, assessments consist primarily of open-ended items that require students to analyze, apply knowledge, and write extensively. Not surprisingly, curriculum and instruction in these countries emphasize activities such as research projects, science investigations, development of products and reports, and presentations in various formats about their efforts. Learning experiences focus on students asking questions, analyzing, and using knowledge to solve meaningful problems. Technology-based assessments have the ability to present complex scenarios and track the details of students' interactions with them. In this active area of research and development, more funding will be needed to produce valid, reliable, and cost effective measures of 21st century skills.

Clearly, assessment has different purposes. Of primary interest are the functions of accountability and informing instruction. Moving from the multiple-choice, basics-intensive tests now in use to more ambitious performance-oriented assessments until recently seemed prohibitively costly. Further, there has been some concern that moving from "bubble tests" to examinations requiring scorer ratings would be too subjective. However, ample evidence now exists that teachers and other scorers can be trained to employ rubrics to rate student performance with high levels of agreement and accuracy. Further, advances in artificial intelligence have made possible the scoring of student writing and responses to open-ended questions. With today's technology the cost of world-class tests is far lower and the speed of getting the results dramatically higher.

To boost educational outcomes, better ways are needed not only to measure long-term achievement but also to identify students' individual strengths and weaknesses in midstream when there is still time to improve their learning. Moreover, the amount of learning time lost to testing can be reduced by embedding assessment in actual learning experiences. Resulting data are useful in guiding instruction and may also be aggregated as summative data for accountability purposes. States could thus reduce use of yearly high-stakes testing and reap substantial cost savings. In brief, technology makes possible an integrated approach for capturing, aggregating, mining, and sharing content and student learning data cost-effectively and quickly for multiple purposes.

Getting teachers wired for 21st century schooling

The task of wiring all our schools for broadband access was one thing; a more difficult challenge is getting the entire teaching force up to speed for technological effectiveness. Through technology teachers gain access to the most effective teaching and learning resources, but educational technology is not transformative on its own. It is powerful only when educators integrate it into the curriculum, align it with student learning goals, and use it for engaging learning projects. Therefore, teacher preparation, professional development, and ongoing support are key issues in employing technology to improve the quality of learning in the classroom.

Teacher preparation and support. Schools of education tend to address technology in a single stand-alone course rather than integrating it in all courses and showing teachers the ways in which it enhance each area of the curriculum. Such integration in preservice preparation would give teachers the attitudes and skills they need to make good use of technology from the beginning of their careers. Schools of education would benefit from assistance in incorporating learning technology throughout their courses, and such change in turn would have considerable payoff in improved teaching in the schools.

Staff development for teachers once they are in the schools is also essential. Well-planned, ongoing professional development that is tied to the school's curriculum goals, designed with built-in evaluation, and sustained by adequate financial and staff support is necessary if teachers are to analyze data and use technology appropriately to promote learning for all students. Teachers in high-achieving nations have far more time than do U.S. teachers for professional development, collaboration, and their own learning. The caliber of teaching needed in our schools today requires sustained time for teachers to engage in these activities during the working week, a fundamental change that will necessitate school reorganization and reallocation of resources.

Teacher accountability and evaluation. A consensus is growing in the federal government and states that it is time for a rigorous, credible system of teacher accountability that explicitly connects to evidence of a teacher's impact on student learning. Strong performance-based assessment of teachers is exemplified by the National Board for Professional Teaching Standards (NBPTS) certification, which includes examining teachers' practice through videotapes of teaching, lesson plans, and evidence of student learning. Studies have found Board certification identifies teachers who are more effective than their peers in raising student achievement. In addition, participation in the process helps to develop good teaching. Several states have created performance assessments for initial licensing of prospective teachers patterned after the NBPTS approach, and these performance assessments have been found to be strong levers for improving preparation and mentoring as well as determining teachers' competence. In combination with such strategies for improved teacher evaluation, compensation and retention policies need to encourage and reward teacher effectiveness. Federal leadership and incentives are needed to spur progress in this direction, and the climate for achieving such progress is better than it has been for decades.

It should be noted that parents as well as teachers have a major impact on student attitudes and learning, and technology brings new possibilities for connecting them to the education of their children. For example, teachers can send home frequent feedback about what students are learning and doing in school and communicate about what parent support could look like for the particular child.

Turning it around—transforming the school as a whole

With far too many schools still unable to raise student achievement, the nation has a pressing need for widespread, scalable, and sustainable reform—school transformation—within the lowest performing schools. Addressing head-on the poverty-related barriers to learning, teaching and school organization is imperative. From research evidence and on-the-ground experience with existing models, the essential elements for success are now clear. They include high levels of accountability, impactful leadership, effective teaching, a positive learning culture, extended learning time, and service integration. Services alone cannot turn around a seriously failing school but are vital to a multifaceted approach to creating a profound school culture shift and establishing effective conditions for learning.

One model that reliably produces such transformation is Turnaround for Children (TFC), a scalable approach that since 2005 has been implemented in over 60 of the lowest-performing elementary and middle schools in New York City. TFC recognizes the effects of poverty on students, staff, and school functioning and works tenaciously to address them. For example, its developers have found that the highest-need students tend to be powerful negative socializing influences in the school through disrupting learning environments and reducing the time all students spend on task. All school personnel (including a school-hired social worker seen as key in the TFC model) focus intensely on these very high-need students, with dramatic effects on school climate. Initially school staff require the training and support of TFC staff. Then over the course of the three-year intervention, a new culture emerges throughout the school so that effects are sustainable and are "owned" by the school. Results include dramatic decreases in police-reported incidents, suspensions, and teacher turnover, along with increases in students at or above grade-level proficiency in math and English. Costs are offset in part by preempting expensive mental health interventions and special education referrals.

Federal policy could require or incentivize states to ensure that persistently low-performing schools have in place the strategies and capacities that have proven effective for school turnaround. Incorporation of systems of support, culture change, and service integration could be required in all reform options—transformation, turnaround, alternative management, and restart. In some struggling districts and schools, external partners such as universities, foundations, and other nonprofits may be needed to enable this process, and federal policy makers can encourage such partnering.

Leverage points for federal leadership and action

Policymakers can help to move education reform by providing leadership in each of the areas discussed above. Specific policy options noted by conference participants included the following.

- Require and incentivize higher-quality assessments and use of technology in assessment for both formative and summative uses. Priorities are assessments of 21st century skills for accountability purposes and assessments giving students, teachers, and other stakeholders timely and useful feedback about student learning.
- To save instructional time as well as resources to invest in more productive assessment strategies, encourage the states to move away from every-grade testing.
- Mandate or incentivize states and districts to put in place in low-performing schools those strategies and capacities that have a successful track record in school turnaround. Policy makers can specify these capacities as essential in any initiatives or programs in which states and other entities are applying for money.

- To promote scalable reform, tie funding to the requirement that states, districts, and other entities *design* for scale from the outset and consider upfront a range of questions, such as what policy barriers exist and how to address these. The Defense Advanced Research Projects Agency (DARPA) model is an example of how a research agency can promote work that builds basic understanding and addresses practical problems. Sponsoring high-risk/high-gain research on behalf of Department of Defense, DARPA is independently managed and staffed by individuals from both industry and academia with relevant expertise.
- To make teachers and school leaders aware of what is available in learning and assessment resources, consider creation of a national registry of these resources and where and under what conditions they have been tried and found successful.

The upcoming reauthorization of the Elementary and Secondary Education Act (ESEA) offers a range of opportunities such as these for revising requirements and redirecting money, such as Title I and II funds.

Educational Innovation with Technology: A New Look at Scale and Opportunity to Learn

Louis M. Gomez, Ph.D.
University of Pittsburgh, and The Carnegie Foundation for the Advancement of Teaching

Kimberley Gomez
University of Pittsburgh

Bernard R. Gifford
University of California, Berkeley

Introduction

Computer-based tools are *social* in nature, not merely technological. Tools help define what is important to accomplish, how one might go about it, and with whom one might work to reach one's own goals or the goals of a group. Education is also a social enterprise. Becoming educated means in part knowing *what* is important to do and who to work with to get something done. In this essay we argue that technology can potentially serve to help students know what to do, how to do it, and with whom.

The evidence that infusing technology in education has, to date, transformed education is decidedly mixed. However, there still remains room for optimism in technology's ability to transform education, in part, because of its almost unique role in enhancing all students' opportunities to learn. Our optimism is tempered by the need to carefully attend to the conditions that might make technology a more successful tool for a broader cross-section of users.

How might the prospect of widespread use of technology in education change the *opportunity equation* in learning environments? Opportunity must be the yardstick of quality by which educational systems are judged, particularly when policy makers and school leaders aspire to educate *all* to high levels. Technology can help grow equality of opportunity as long as its use is informed by nuanced approaches to the design and use of technology for learning. This essay will highlight some of what we mean by these nuanced approaches and the ways in which technology might be used to alter the opportunity equation in education.

Reliability and Context

The hard problem when it comes to technology-based innovations in education is not access but effective use at scale. The key to genuine innovation is getting beyond the "hothouse" where innovations have demonstrable utility for a few but unrealized value for the many. Ultimately, effective scale requires a discipline where innovations are reliably useful across diverse contexts and where innovators use context as a resource to improve innovations (Langley et al., 2009; Bryk, 2009). In education, an attention to reliability is rarely standard operating practice. We are usually left with sub-optimal innovations that have utility for some but not all. By way of an example, let's briefly interrogate the case of one-to-one computing.

The Case of One-to-One Computing. One-to-one computing is a useful case-in-point because it has captured the public imagination and policy maker interest. With some justification, technologists and educators have argued that putting computers in the hands of every learner will allow schooling to take a kind of magical turn into the 21st century. Personal access to computation can almost certainly offer learners a vast new array of opportunities to learn. Though there is great potential, there is significant variability in the apparent utility of one-to-one programs for students. The real question is how to move from promise to practice so that students across a broad spectrum of backgrounds and settings can use a tool like this effectively. To date, the benefits have not been at all reliable across the many contexts of one-to-one computing in America. Some students use computers to find out why lobster populations are changing along the Maine coast while others spend hours learning the ins and outs of word processers as the "new typewriters" of the 21st Century. It is important to understand this variability as a key roadblock to real innovation and improvement at scale. If innovations routinely "break" in the hands of some users, and not others, variability is a roadblock rather than a resource. The challenge of innovation is to make variability a resource so that we understand how to contribute to the reliable use of tools across diverse contexts.

The field is beginning to look carefully at this issue of variability. For example, Warschauer (2006) suggests that successful use of laptops in a one-to-one computing environment in Maine is at least partially dependent on setting. Warschauer offered case study examples to suggest that communities with higher levels of social advantage found productive uses of laptops while those with less social capital settled for less productive uses of computers. Most of these laptop initiatives report underestimating the difficulty of coaxing valuable use of the resource because of insufficient attention to elements of context and setting, from preparing teachers to engaging parents to rethinking curriculum.

In many ways, the controversies and analyses that are unfolding around today's one-to-one laptop programs are essentially recapitulating the discussions and controversies that unfolded around computers in the classrooms a decade and a half ago (e.g., Wenglinsky, 1998). With 20-20 hindsight, the results from those analyses seem to be relatively clear. First, access was not the real problem—getting computers into classrooms, while difficult, was "doable". Second, the available resources, training, and social contexts of schools essentially determined a lot about productivity of use. Perhaps the most important lesson from these earlier efforts was that computers did not magically transform schools when these tools were delivered to schools accompanied by a broad mandate to use them but with no specificity about how to use them in specific contexts to support learning. These results are not unlike much earlier reports of book give-away programs in which parents with greater social advantage used books in ways that helped children develop intellectually, whereas parents with less social capital used books in didactic interactive ways that did not encourage children to become independent readers (Brice-Heath, 1982).

It is clear from all of these examples that when complex, multifunctional devices like computers are introduced into the lives of children, they become part of a complex social ecology (Warschauer & Matuchniak, 2009). Without recognition and appreciation of that ecology, computational tools turn out to be agents that recapitulate the social settings in which they find themselves. In short, real educational innovation with technology, perhaps innovation in general, is impossible without also acknowledging, preparing for, and addressing the challenge of variability in students and the contexts of their lives.

Being Explicit as a Way to Address Variability of Contexts

Bringing innovations to scale is a process. The goal should be not to reach a static endpoint but rather to develop a set of tools and

strategies that allow for continuous process improvement. From domains as diverse as manufacturing and medicine, innovators who seek continuous improvement have focused on the value of explicitness as a means to corral variation so it serves as a resource that can lead to improvement at scale.

There are at least three ways to be more explicit about an educational innovation: clarifying intended utility; specifying target audience; and continuous measurement. First, it should be clear what the innovation is and how its designers intend it to be useful to its users. If left underspecified, an innovation may fall prey, either implicitly or explicitly, to naïve users' manifest benefits tests in which users essentially ask, "What's in it for me?" (Rogers 2003; Brown & Venkitesh, 2005). It is not that people should be prevented from asking this question, nor is it likely that it can be prevented. Rather, it is important to anticipate and provide support for users as they explore how an innovation can be useful to them. Innovators often think that the key challenge is helping practitioners understand *that* a particular technology innovation is important rather than why, how, and for whom it is important. Organizational analysts like Pfeffer and Sutton (2000) suggest that for innovations to gain traction, more time ought to be spent helping practitioners understand *how* an innovation fits into their lives. Pfeffer and Sutton call this "managing the knowing-doing" gap.

Video: Seeing Use in Context

Recent advances in the use of digital video for instruction may be helpful in addressing the knowing-doing gap. It is now possible to capture and share a variety of aspects of practice with an innovation so that others can have ways to see how an innovation might be useful across a variety of settings. It is one thing, for example, to "tell" teachers that they can work within environments where all students have computers. It is quite another for them to have access to rich examples of other teachers in settings like theirs, and different from theirs, where computers are in use, by all students, in educationally ambitious ways. Of course, the point is that what is educationally ambitious varies significantly by context. In a community where the average family has multiple computers in the home and has had them for several years, what is ambitious and how quickly one can establish a norm of ambitious use in the school will be very different than in a community where, the computer that arrives, because of a one-to-one computing program, is also the first computer to be resident in the home.

While video examples can be extraordinarily valuable in bridging the knowing-doing gap, accomplishing this is not without its challenges. Following Derry et al., (2010), researchers and developers have to pay careful attention to: (1) the selection of video examples that will have meaningful traction in various communities, (2) how those examples are parsed and analyzed for consumption, and (3) what video-based technology is best to deliver them given the goals (e.g., should video be annotatable or simply passively viewed).

Explicitness in Context

A second important dimension of explicitness is clarity about the audience for an intervention: Who will it help, what kinds of goals can it support, and what is the system of resources that users have access to are all critical elements of explicitness of audience. Shared specification of outcome, audience, and resource definition is necessary.

While it seems simple, when attending to issues of context, explicit characterization of the audience for an innovation is often underspecified and not uniformly shared within a community of actors. It is not uncommon to hear proponents of one-to-one computing for example, when asked, "Who is the innovation supposed to help?" often reply, "All children." Similarly, explicit characterization of innovation *intent* is typically underspecified. When asked, "To do what?" it is not uncommon to hear, "Schoolwork." While relevant, these responses are not particularly helpful for

improvement at scale. Improvement experts (Langley et al., 2009) would suggest that it is important to specify coherent sub-problems and subpopulations of teachers and students in thinking about the utility of an innovation or tool. For example, the process of homework completion could be an excellent site for the use of personal computation. In such an example, innovators might be asked how they might characterize students in relation to targets for homework completion or completion quality. Having specified this, innovators might go on to explicitly characterize the system resources that would have to interact effectively for the identified students to reach the completion targets. System resources as they relate to homework completion or completion quality might include whether computers are used in a family for professional, home business, and social activities. It would also likely include the extent to which a school relies on computers to communicate with students and families about the process of schooling, whether a school makes available things like homework assignments on the web or makes it possible for students to check progress via the web.

Measuring Effectiveness in the Context

The third dimension of explicitness is measurement. To improve educational processes one needs data. Quite simply, you can't improve at scale what you cannot measure. Measurement, however, must be purposeful. Measurement should be guided by a working theory of the anatomy of the educational process that one seeks to improve. An explicit working theory is essential because improvements and interventions have undergirding cause-and-effect logics that specify causal links from an idea for improvement to the desired outcome (Bryk, 2009). When the cause-and-effect logic is tacit, data collection is, at best, unorganized. It then becomes very difficult to discern if a change is really an improvement in educational process. For example, suppose innovators have a belief that the homework completion rate is linked to students' personal access to a computer at home. Surely, such a theory also includes beliefs about parents' computer knowledge and other aspects of the home environment. In this case it would be very difficult to know if homework processes improved without measuring all aspects of the student homework system. In short, we need data that treats educational processes explicitly with organizationally-agreed-upon measurement systems to move forward toward scale. Today educational innovations are not often undergirded by shared notions of audience, outcome, and rigid adherence to agreed-upon measures of success.

Data, in the sense that it is meant here, is more than simply warehoused information that is periodically brought to bear on educational situations for some form of summative decision-making. The purpose of data envisioned here is to spur social interaction aimed at continuous improvement. In many ways, these ideas flow from the insights of Brown and Duguid (2000) about the social life of information. They conjecture that information gains value in a social context. It is not merely an absolute commodity to be captured and sold, as in e-commerce, or to be considered only in terms of how much we have and how fast we can move it around. Instead, data provides an occasion for people to talk and problem solve. Like other domains where data has informed improvement, its real value is providing nuanced insights into the nature of variation in local contexts. Given that the big educational payoff of data is broad-based process improvement, much of the data collected for educational purposes today is not up to that task. Computers and technology can help. The next section takes up a new role for computers and the data computers can produce in a bit more detail.

Improving Educational Processes With Micro-Process Data

Today much of the data that educators have available to them to inform change is far too macro to be useful for process improvement.

High stakes tests, for example, capture large swaths of time measured in months and years. Much of the important teaching and learning that occurs in schools happens in intervals of minutes, hours, and days. Information technology can move the site of data collection closer to the actual unfolding of work processes, thus making important aspects of the work measurable and open to improvement. When computers are in the hands of learners as they work it is possible to collect fine-grained data about educational processes as they unfold. One way to refer to this kind of focus on data is *micro-process data* aimed at continuous improvement. When micro-process data grows directly out of student work and is also coupled to a common set of outcomes for students, it offers innovators an opportunity to understand in detail how learners perform differently within common student work settings and assessment activities. As such, it offers an opportunity to think about the design of student work that is differentiated rather than lockstep (one size fits all) assessments that are grounded in information about each student's performance rather than just customary temperature-taking-centered accountability.

Better micro-process measurement, and a focus on using data to improve granular work processes, could help address the extraordinary variation in educational achievement and attainment in United States education that displays itself in gaps that separate low-performing students from higher-performing ones. A focus on educational processes, and their improvement, does not, and should not, diminish the reality that real change in educational opportunity must take on a task that Larry Cuban (2010) argues that past generations of reformers have avoided, namely, "the hard, political work of either fixing those socioeconomic structures that sustain poverty and striking inequalities in wealth or funding comprehensive programs of support for low-income adults—or both." That said, one might ask the question, "What other avenues are open to address the variability that manifests itself in differences among students (like their diverse levels of proficiency, their different rates of learning, their ability to make sense of different types of curriculum materials, and in their sense of themselves as capable learners) so that more students can experience success?

Technologies in the hands of students offer a chance to address this variability by interrupting traditional, organizational regularities of the conventional classroom. For example, they can interrupt the dominance of whole-class instruction, the notion that a uniform pace of instruction is pedagogically sensible, and the belief in preset curriculum materials and assessments.

Micro-process data allows learning environments to be customized in at least three important ways: (1) the nature of feedback learners receive—customized feedback represents an effective means for helping students channel effort in more useful ways, (2) the types of scaffolds, or support systems for learning, that are created for learners, and (3) the examples learners use for sensemaking in problem solving. Sensemaking refers to the process people use in giving meaning to experience; that is, the connections they make to prior experiences and the ways of making these connections to organize knowledge. Particularly important, in this essay, is how learners get to use worked examples, from mathematics and other domains, to help categorize their experience. For example, two differently-worked-out mathematics problems allow the learner to see the multiple methods that they can engage in for a solution.

Today there are a growing number of applications based on technologies like latent semantic analysis (Landauer, Foltz, & Laham, 1998) that allow researchers and designers to develop tools that can give learners, and their teachers, immediate feedback about a student's writing that has been shown to support students as they iteratively construct better summaries of readings. Scaffolds, such as customized opportunities for practice, matter to achievement. Instruction too often relies on lockstep approaches and rigid pacing. Yet, there is considerable evidence

to suggest that anticipating student errors and common misconceptions in problem solving can improve learning. Technology can become a real scaffold for customized opportunities to practice problem solving. Intelligent tutoring systems, like the Carnegie Learning Algebra Tutor (Ritter, Anderson, Koedinger, & Corbett, 2007), support mathematics learning in part because the Tutor has detailed representations of what students know and are therefore able to offer practice problems to solve that better address students' zones of proximal development.

Finally, micro analysis of learning helps develop students' sensemaking. One of the most powerful mechanisms to spur learning is analogy (Gentner, 1989). Comparison matters. One example, paired with another, can allow us to see dimensions of commonality and allow sensemaking that can result in generalizable learning. The power of analogy and similarity for learning is quite pervasive from simple perception to advanced mathematics. For example, in algebra learning, worked examples matter to performance (e.g., Atkinson, Derry, Renkl, & Wortham, 2000). Some examples work better for some learners than others because of differences in prior experience and mental reference. Therefore, having a technology that can automatically create a wide range of worked examples for the purposes of comparison learning can be extraordinarily valuable. An example of an online technology tool that allows for the creation of a vast storehouse of worked examples in mathematics is Learning Conductor (Gifford, 2009). The value of tools like Learning Conductor is that they have a large collection of worked examples and more than any one teacher, or student, could create on his or her own. Insight from research suggests that different learners gain value from different sorts of examples.

Feedback, scaffolds, and opportunities for sensemaking matter deeply to learning. There are three key points that deserve attention from the examples above. First, there is starting to be a robust class of technologies that allows for customizing interactions with learners along important cognitive and social dimensions. Second, these new information technologies can facilitate a granular and a data-centered attention to feedback, creation of scaffolds and analogy-centered learning. And, third, and perhaps most importantly, what is missing in current conversations about technology at scale is a sharp focus on how to place these technologies, and the data that they produce, in the context of well-defined instructional processes that can be iteratively improved in light of experience. While there has been a lot of attention to perfecting these, and similar technologies, there has been relatively little attention paid to placing them within systems that are centered on using the data for learning to make the microprocesses of education better. Such systems demand that the data be shared and focused on common targets for performance that aim to help students with specific characteristics.

Conclusion

This essay addressed how educational innovations with technology might have an impact on opportunity. Rather than offering a list of new technologies and new tools that are poised to change education, the focus, here, has been on three considerations that the authors believe need to be placed at the forefront to increase the likelihood that innovations will have an impact on the opportunity equation. First, it was argued that reliability is important. The important question that policy makers need an answer to is: "How will a proposed innovation perform in the face of contextual variation?" The sense of performing that this essay is getting at is not simply that an instrument works according to technical specifications, but that, when the tool is placed in the context of a variety of routines and cultural settings, it will be useful to local practitioners. Without this sense of reliability, local communities seeking to improve practice are asked to take undue risk and incur undue costs when engaging new tools with organizational improvement in mind. Second, policy makers need to attend to the ways in which an innovation generates and

uses data to help ensure that diverse individuals will gain value from the innovation. We need to evolve administrative and political structures that cut across the public and private sectors that will be the social arbiters to insure that tools work for diverse groups of people. Third, policy makers should know how innovations address the opportunity equation. Essentially, this essay has sought to broaden the educational technology conversation beyond "stuff and things" to a more nuanced discussion about ways that technology might broaden opportunity to learn.

References

Atkinson, R. K., Derry, S. J., Renkl, A., & Wortham, D. (2000). Learning from examples: Instructional principles from the worked examples research. *Review of Educational Research, 70*(2), 181-214.

Brice-Heath, S. (1982). What no bedtime story means: Narrative skills at home and school. *Language in Society, 11,* 49-76.

Brown, J. S., & Duguid, P. (2000). *The social life of information.* Cambridge, MA: Harvard Business School Publishing.

Brown, S. A., & Venkatesh, V. (2005). Model of adoption of technology in households: A baseline model test and extension incorporating household life cycle. *MIS Quarterly 29*(3), 399-426.

Bryk, A. S. (2009). Support a science of performance improvement. *Phi Delta Kappan, 90*(8), 597-600.

Cuban, L. (2010). Utopian rhetoric again and again: American DNA and the failure of school reformers to kick the habit. *Teachers College Record*, June 01, 2010, ID Number: 15997.

Derry, S., Pea, R. D., Barron, B., Engle, R. A., Erickson, F., Goldman, R., … Sherin, B.L. (2010). Conducting video research in the learning sciences: Guidance on selection, analysis, technology, and ethics. *Journal of the Learning Sciences, 19*(1), 3-53.

Gentner, D. (1989). The mechanisms of analogical learning. In S. Vosniadou & A. Ortony (Eds.), *Similarity and analogical reasoning.* (pp. 199-233). New York: Cambridge University Press.

Gifford, B. (2009). *Addressing the incommensurability between state-administered, standards-based exams in mathematics, and the assessment-mediated problem solving exercises required to support coherent and progressive learning and teaching in the classroom.* Paper presented at Berkeley Evaluation and Assessment Research Seminars, Berkeley, CA.

Landauer, T. K., Foltz, P. W., & Laham, D. (1998). An introduction to latent semantic analysis [Special Issue]. *Discourse Processes, 25,* 259-284.

Langley, G. J., Moen, R. D., Nolan, K. M., Nolan, T. W., Norman, C. L., & Provost, L. P. (2009). The improvement guide: A practical approach to enhancing organizational performance. San Francisco, CA: Jossey-Bass.

Pfeffer, J., & Sutton, R. I. (2000). *The knowing-doing gap: How smart companies turn knowledge into action.* Cambridge, MA: Harvard Business School Publishing.

Ritter S., Anderson, J. R., Koedinger, K. R., & Corbett, A. (2007). Cognitive tutor: Applied research in mathematics education. *Psychonomic Bulletin & Review, 14*(2), 249-255.

Rogers E. (2003). *Diffusion of innovations.* New York: Free Press.

Warschauer, M. (2006). *Laptops and literacy: Learning in the wireless classroom.* New York: Teachers College Press.

Warschauer M., & Matuchniak, T. (2009). New technology and digital worlds: Analyzing evidence of equity in access, use, and outcomes. *Review of Research in Education, 34*(1), 179-225.

Wenglinsky, H. (1998). *Does it compute? The relationship between educational technology and student achievement in mathematics.* Princeton, NJ: Educational Testing Service.

Learning Technology in Context: Time for New Perspectives and Approaches

Barbara Means, Ph.D.
Director, Center for Technology in Learning
SRI International

Today, hundreds of millions of people are walking around with a smart phone that has more computing power than the early supercomputers. High school students wonder why their class tests ask them questions that could be answered in less than a second with an Internet search engine. A technologically transformed world cries out for a transformed education system.

One vision for such a system appears in the new National Educational Technology Plan (www.ed.gov/technology/netp-2010). The plan describes how technology can support: (1) more engaging and effective learning; (2) assessing 21st century competencies in problem solving, collaboration, research and design; and (3) restructuring teaching practice to capitalize on the best available expertise and foster teachers' learning and professional growth. A few examples of recent technology applications illustrate these ideas.

New Technologies with Promise for Education

One of the most striking technology developments over the last five years has been the spread of **low-cost, mobile yet powerful computing devices**, such as portable media players, smart phones and e-books. Any of these can be used to access educational material, extending the learning day by making it possible to study whenever and wherever you like. They can also be used to provide a motivating practice environment. At an elementary school in Escondido, California, for example, students increased their reading fluency after working with an application that gave them daily practice reading as many words as they could in a minute. Having the opportunity to playback their recordings and hear themselves read, these young English learners became much more motivated in improving their skills and made unusual progress compared to other classes.

A second dramatic example of technology growth is **social networking and Web 2.0** applications. These technologies put people with a common interest in touch with each other and make it possible for students to be producers—and not just consumers—of digital content. The first hints of how these technologies may change teaching and learning roles are starting to emerge. One example is Project K-Nect, an effort by several North Carolina school districts that provides at-risk high school students with smart phones and encourages them to use instant messaging and blogging to post and answer questions related to their math homework. Dumbfounding even the project's advocates, students posted 75 different videos on how to solve a linear equation during the project's first week.

Teachers, too, are benefiting from the social web. The Vail School District in Arizona, for example, has developed a web-based system

containing lesson plans, instructional materials, and assessments linked to standards. Teachers post their own standards-linked materials and share tips on how to teach specific topics.

Online learning resources, not just blogs but simulations, digital versions of books, historical and cultural artifacts, as well as whole courses and degree programs, have grown exponentially over the past decade. The Sloan Consortium estimated that over a million K-12 students took online courses in 2007-08, an increase of almost 50% from just two years earlier.

Another active area is the use of **simulation environments** for learning and assessment. River City, a multi-user virtual environment developed by a Harvard research program, takes students back in time to a simulated 18th-century industrial town. Students move through the River City 3-D virtual environment to collect data and run tests in response to the mayor's challenge to find out why River City residents are falling ill. Student performance is assessed by analyzing the reports that students produce for the mayor and the kinds of information that students choose to examine and their moment-to-moment actions and utterances in the virtual environment. With this kind of information, researchers constructed measures of science inquiry skills as well as measures of how well students understood science concepts.

The premise that new technologies can transform education is far from new, of course, but so far technology has had a deep influence in some individual projects or schools but has not produced system-wide change. A comparison can be made with the introduction of computers into service industries in the 1990s. There was no productivity benefit until businesses engaged in process reengineering to do things differently. Large-scale improvements in educational effectiveness can be expected only when schools engage in comparable process reengineering.

There are, however, factors making it hard to re-design the education system to fully leverage technology. These include accountability pressures that reduce the amount of time spent on learning anything that is not covered on the state test, budget crises, difficulty measuring the value added by technology, and polarized attitudes around the benefits of technology experiences for students. The discussion below seeks to dispel overly positive and overly negative attitudes toward educational technology by providing some perspective on how to appraise its value.

Technology as Part of an Integrated Approach

The many different kinds of technology and different ways in which those technologies can be used in education make it impossible to give a blanket answer to a question like "Is technology effective?" Even when the question is narrowed to a specific technology application, evaluating its effectiveness is much more complicated than most people realize. To illustrate this complexity, I will use the example of recent work led by my SRI colleague Jeremy Roschelle. His research team studied a new approach to teaching key concepts in middle school mathematics (rate, proportionality, linear functions) that pave the way for algebra and calculus in secondary school. This approach incorporated SimCalc *Mathworld* software (originally developed by a mathematician at the University of Massachusetts Dartmouth). The SimCalc software presents students with animations of motion in everyday experience, such as a foot race or two elevators, with the animations linked to manipulable, dynamic, mathematical representations such as graphs, geometric diagrams, tables, and algebraic expressions.

The research team understood that simply installing SimCalc software in schools was unlikely to produce the desired learning for most students. The team developed an integrated instructional approach that included lesson activities, curriculum workbooks, and training for teachers on both the math concepts in SimCalc and on how to implement the instructional modules.

Having developed an integrated instructional approach, the R&D group was then in

a position to test whether, and under what conditions, that integrated approach increases student learning. In a series of randomized experiments conducted in over 100 Texas schools, the research team assigned teachers at random to either use the SimCalc approach or to teach rate, proportionality, and linear functions in their usual way. Each of the experiments showed that students in classes using the SimCalc approach had better results, regardless of whether the students were male or female, Hispanic or Anglo, low-income or not.

Polarized Attitudes About Technology: Some Common Myths

The above description of the SimCalc research sets the stage for examining some misconceptions about the value of educational technology that should not be the basis for policy decisions, but often are.

Myth: If classrooms have the latest technologies, students will learn more. Whenever a new technology comes out, there are always enthusiasts who immediately want to bring it into the classroom. Students are eager to work with new technology, but that does not necessarily mean that they will learn more. The SimCalc research team understood that technology by itself does not produce meaningful learning for the majority of students. Effective introduction of new technologies requires investing in integrated instructional approaches that leverage the capabilities of the technology and incorporate professional development so that teachers learn how to use new materials and technology effectively. Policymakers should think about educational technology investments in terms of all of these components of an integrated instructional approach: curriculum, technology, and professional development.

Myth: There is no evidence that technology improves student learning. At the other end of the spectrum, technology skeptics claim that—despite billions of dollars investing in technology for schools—there is no evidence that technology enhances student learning. In fact, scores of studies like the SimCalc research show that particular technology-supported instructional approaches had positive effects for students. But other studies involving technology have found no impact. What can a policy maker infer from such research?

First, talking about whether or not "technology" is effective is akin to talking about whether or not textbooks or pens are effective. There are many different kinds of technology applications and different ways in which these resources and systems can support learning. Blanket statements about educational technology being effective or ineffective are meaningless. There is no escaping the need to consider the specifics not only of the particular technology but also of the instructional approach of which it is a part. The quality of the learning activity as a whole (including those portions that do not involve technology), and the teacher's skill are critical components of students' learning experiences and can have major effects on learning outcomes. Thus, the first step in answering a question about effectiveness is describing all essential elements of the instructional approach required to achieve a better result.

Skepticism about the return on educational technology investments is understandable. To enable the use of technology in instruction, a state or school district needs to invest in an infrastructure that has significant costs. The potential benefits stem not from installing the infrastructure per se but rather from specific uses of that infrastructure by teachers and students. Measuring the benefits of technology investments requires knowing about those uses, measuring student outcomes associated with each of them, and aggregating these benefits across all the uses made of the infrastructure.

Myth: Proven software has the same effect every time. When the Food and Drug Administration (FDA) finds that a drug is effective, doctors and consumers assume that it will work for a very broad population in much the same way—that the variability of effects is fairly low. This assumption rarely holds up in education. A corollary of the point made above—that a

technology is just one piece of a multi-part instructional approach—is that what students get out of using the technology will depend on the context of use. In education, the variability of effects is very large.

This variability was documented in a set of large randomized control trials testing the effects of 16 software products designed to teach either reading or mathematics. Mimicking what happens when districts purchase software, the experiment had software distributors provide their usual teacher training and support but did not impose a uniform implementation model on schools and classrooms. Trials on the effects in the first year of implementation found no overall effect on student achievement at any of the four grade levels in the studies. Students in the treatment classrooms did better than those in control classrooms in some schools, worse than those in control classrooms in other schools, and virtually the same in still others. Such findings show that picking a piece of software or a technology tool that "worked" in one setting is no guarantee of equivalent results in other places and with other kinds of implementation.

Rather than seeing technology as a drug or silver bullet, a better perspective in education is to see technology as grist for the mill of continuous quality improvement. Of course, schools should start with a technology-supported instructional approach that has a solid research base. But to realize consistent, strong, and long-lasting effects, school systems will have to focus on continuously improving the complementary elements that leverage the technology, such as re-organization of the physical classroom space, teacher professional development, curriculum, and assessments. Strong effects in education come from continuous improvement efforts that address all the necessary system elements and measure results frequently using appropriate benchmarks.

Myth: It's more important to invest in student data systems than in technologies for learning. Pitting data and learning systems against each other in a forced choice makes no sense; school systems need both kinds of technology and, in fact, the two can support each other.

A majority of school districts now use local student data systems and end-of-unit or benchmark testing to give both teachers and administrators access to timely student data. Federal education policy strongly promotes teachers' use of such data to inform their choices about appropriate instruction for each student. But data systems tell you what students have and have not learned in the past; they cannot produce learning.

Learning technologies can provide more detailed information than district data systems do by embedding assessment in the learning activities themselves. Good teachers have always done informal checks on student understanding during instruction, but informal assessments are usually not uniformly applied or documented in a way that would make them available for later reflection or inspection by others. When students learn online, however, the technology can handle not only the assessment but the storage, analysis, and presentation of student assessment data. Modern technologies for learning can generate information about each student's learning at a level of detail that is more useful for teachers than the data found in systems designed for accountability.

Needed Steps and Policy Implications

The need to prepare students for a competitive, fast-changing world provides strong motivation for incorporating technology into education. But technology benefits will be limited if a thoughtful integration with curriculum, assessment, and teacher training is absent.

Other countries see the integration of technology into education as critical for fostering advanced skills and an innovative mind set. Singapore provides a strong example of strategic use of technology to catalyze changing their traditional education system in ways that better prepare students for the modern economy. Although Singapore has led the world in many international assessments of student

achievement, the country has been concerned that it was preparing its students to be technically proficient but not innovative. Under its first five-year master plan for technology in education, Singapore spent the equivalent of $1.2 billion (in a country of 4 million people) to install computers and high-bandwidth Internet in every school and classroom and to train teachers on the integration of technology into instruction. Subsequent master plans have emphasized the integration of technology with curriculum, assessment, instruction, professional development, and school culture. Singapore has chosen to reduce the number of topics in its school curriculum by 10-30% to allow for the integration of technology into the subject areas ("teach less, learn more"). In addition, Singapore revised its university admission criteria to include the submission of an electronic portfolio of student work in addition to exam scores. Singapore is actively importing research-based technology-supported innovations from the United States and other countries, and studying what is needed to scale these up in Singapore's culture. Singapore is very deliberately investing in research on implementation and on achieving not only the old metrics, but also 21st century skills.

If the American education system is serious about having students attain the competencies needed for success in a globally competitive world, systemic change will be needed. Technology can support extended learning time and more individually adaptive and effective instruction; assessing 21st century skills; and restructuring teaching practice in ways that capitalize on the best available expertise and foster continuous professional learning. All of this requires not just the availability of computers and broadband access but also human capacity supported by organizational structures and supportive policies. The foregoing suggests the following implications for U.S. education policy:

Focus planning on integrated instructional approaches rather than technology per se. A technology infrastructure is essential but policy makers should not fall prey to the myth that technology by itself is going to produce dramatic improvements in student learning. Instead they should think about integrated approaches—a three-legged stool, with the curriculum design and professional development legs providing support along with the technology leg.

Technology-supported educational innovations should start small, get smart, refine and then scale up. Policy makers should avoid the fallacy of assuming that a technology-supported approach that has had positive effects in one set of circumstances will necessarily be effective in their own setting. Districts should not follow the example of the Los Angeles Unified School District, which spent $50 million buying a piece of commercial early reading software for all its elementary schools, only to find that most teachers did not even use it because it was incompatible with the district's core reading program. Instead they should look to the example of Long Beach Unified, which customarily tries any new intervention out in a few schools, measures effects and school perceptions, and then designs improvements before trying the intervention on a broader scale.

Measure students' competencies in "21st century skills" embedded within subject areas. There is broad consensus that today's world requires being able to reason and apply what one knows to new situations and to acquire new learning. Unfortunately, conventional paper-and-pencil tests do a poor job of measuring complex performances and the ability to learn from experience. Technology can support extended problem-based learning activities that provide opportunities to acquire these competencies. But it will be difficult to demonstrate the value of these learning opportunities without valid, reliable measures of these types of learning outcomes. Technology-based assessments, with the ability to present complex scenarios and to track the details of students' interactions with them, have the potential to fill this gap. This is an active area of research and development, and more R&D will be needed before we have valid, reliable, and cost effective measures of 21st century skills.

Design appropriate technology supports into every major education initiative. Under the right circumstances, technology can support better learning, assessing important complex skills, and acquisition and analysis of the data that can inform efforts to improve. Rather than treating technology deployment and use as an end in itself, education policy makers should integrate technology into core education initiatives in areas such as early literacy, STEM (Science, Technology, Engineering and Mathematics) learning, and college readiness. Many technology advocates take the other side of this issue, fearing that educational technology will not get the funding or attention it needs if there is no federal or state funding dedicated to it. Their concerns are not ill-founded. A transition period, during which funding enhancements are available to support the integration of technology into core education initiatives (as opposed to subsidizing technology purchases per se) makes sense.

Do not assume that the U.S. has overcome technology access and digital divide challenges. A child's zip code should not determine whether or not he has the opportunity to engage in technology-supported learning activities in school. The e-Rate and Title II of the Elementary and Secondary Education Act have addressed this issue with funding for Internet connections, technology purchases, and technology-related professional development. The measures of technology access that have been tracked by the Department of Education since 1994 show tremendous progress toward universal technology access in schools, albeit using technology access measures that have become outdated. An estimated 94% of instructional classrooms have Internet access, and there is an Internet-connected computer for every four students in U.S. schools. But the computers measured by this latter indicator are not necessarily in classrooms, nor do they necessarily have reliable broadband Internet access or the memory to run current versions of software. Many classrooms have only a single functioning Internet-connected computer intended for teacher use. Moreover, recent data on more specific kinds of technology supports in schools show disparities by community type and concentration of low-income and minority students. For example, while 92 percent of secondary schools with few low-income students provide students with server space for storing their work online and with electronic access to the library catalog, only 72 percent of secondary schools with higher concentrations of poverty do so.

The key issue is meaningful use of technology to support learning. To what extent do students at different grade levels, from different demographic profiles, and in different courses have opportunities to use technologies in ways that help prepare them for an innovation economy? Answering this question requires thoughtful definition of meaningful use and surveying classroom teachers, not just district administrators or technology coordinators. This kind of information will be essential to evaluating the effects of new policies around educational uses of technology.

Innovative Designs for Persistently Low-Performing Schools: Transforming Failing Schools by Addressing Poverty-Related Barriers to Teaching and Learning

Pamela A. Cantor, M.D.; Deborah S. Smolover, J.D.; Joan K. Stamler, Ph.D.
Turnaround for Children, Inc.[1]

The Role of Poverty: The Key to Unlocking the Problems of, and Solutions for, Failing Schools

In announcing his vision of "A Great Society" in 1964, President Lyndon Johnson succinctly captured the crucial relationship between poverty and education: "Poverty must not be a bar to learning, and learning must offer an escape from poverty."[2] A year later, the most significant source of federal support for K-12 education, the Elementary and Secondary Education Act (ESEA), passed as part of Johnson's War on Poverty. In the near-half century since the passage of ESEA, one the strongest and most consistent themes in American discourse has been the power of education to provide a pathway out of poverty and into the middle class. And indeed it has: educational attainment is strongly linked to economic success; and the gap in earning power between educated and less-educated workers has been growing dramatically since the 1980s.[3] Nevertheless, Johnson's emphasis on the role poverty plays in impeding educational success has largely been ignored in the current education reform debate. Today, all across America, poverty does in fact present a bar to learning. The effects of poverty will undoubtedly continue to undermine our nation's ability to effectively educate our children if these effects are not fully understood and directly addressed in the design of high-poverty schools. Indeed, it is in understanding and addressing the effects of poverty that both the problems of, and solutions for, persistently low-performing schools and the intractable dropout problem lie.

In this paper we argue that solutions for transforming persistently low-performing high-poverty schools into centers of academic excellence lie in addressing head-on poverty-related barriers to learning, teaching, and school organization. Valuable insights can be gained from analyses of the innovative outliers—the small but powerful number of high performing/high poverty schools that show that zip code does not determine student destiny—about what high-poverty schools need to succeed. Seminal studies of such schools have produced compelling evidence of the "essential elements" of highly effective high poverty schools. These include high levels of accountability, impactful leadership, effective teaching, a positive learning culture, extended learning time, and service integration. Highly effective charters and school management organizations are leading examples of whole-school approaches that incorporate many of the "essential elements" within a given school—particularly the crucial "essential element" of creating a profound school culture shift that establishes effective conditions for learning. However, notwithstanding these remarkable innovations, the problem remains that the vast majority of high-poverty public schools are left untouched and millions of high-poverty children are left undereducated.

This paper offers the Turnaround for Children (TFC) model as an example of a scalable solution for high-poverty public schools that recognizes the effects of poverty on students, staff, and school functioning, addresses those barriers to learning, and creates a school culture that provides the necessary conditions for effective teaching, learning and academic achievement. The TFC model posits that if high-poverty schools develop the capacity to address poverty-related barriers to learning, and if this capacity-building and culture change is coupled with what has been learned from other innovative models (about effective leadership and teaching, extended learning time, and the need for common core standards), then widespread, scalable, and sustainable system reform in America's lowest-performing public schools is truly possible. Such transformation can put our nation back on the path to achieving ESEA's original vision—where poverty is no longer a bar to learning, and a quality education offers all our nation's children an escape from poverty.

A Nation in Crisis: The Costs of Rampant School Failure

The vast number of failing schools across America represents a national crisis. Approximately 30% of schools nationwide are considered chronically underperforming,[4] and 6.2 million youth between the ages of 16 and 24 are dropouts. In many communities, this number represents nearly 1 in 5 men. Among female dropouts, 40% become teen mothers, and 64% of children born to unmarried teenage high school dropouts live in poverty. This rampant school failure undermines our moral obligation to provide a quality education to all children and exacts enormous economic and social costs. Compared to graduates, high school dropouts are four times more likely to be unemployed. Cutting the number of dropouts in half would generate $45 billion annually in tax revenue. School failure devastates America's global competitiveness. From the 1960s to 2006, the United States fell from 1st to 18th out of 24 industrialized nations in high school graduation rates. Closing the achievement gap with other nations could have increased the 2008 Gross Domestic Product by $2.3 trillion. The social costs of school dropouts are equally troubling, with the "school to prison pipeline" serving as one staggering example. Dropouts are 8 times more likely to be incarcerated than high school graduates; 82% of those in prison are high school dropouts; and states spend more than $44 billion per year on incarceration costs. The critical importance of addressing school failure, and its attendant social and economic consequences, simply cannot be overstated.

The Role of Poverty in Underperforming Schools

The problem of underperforming schools is firmly rooted in the relationship between poverty and school failure. The preponderance of the nation's failing schools are located in high-poverty urban neighborhoods,[5] communities afflicted by a host of social problems: unemployment, homelessness, substance abuse, community violence, domestic violence, child abuse, teen pregnancy, incarcerated parents, community inefficacy. Students in high-poverty communities have a disproportionate number of serious health, mental health and behavioral problems; high-poverty families often lack the social capital to advocate for their children; and poor urban neighborhoods lack adequate resources to address the profound level of need. One recent New York City study showed that fewer than 10% of the poorest children requiring mental health services are receiving them; and of those enrolled in services, over 50% are classified as having serious emotional disturbances.[6]

Children do not leave the problems of high-poverty communities at the schoolyard gate. The effects of poverty serve as barriers to learning, as children living in poverty and exposed to trauma all too often come to school sad, distracted, disruptive, and disengaged. High-poverty schools, however, are not designed to address the myriad of issues children bring to

school that affect learning; and even the best teachers are not trained and skilled to address the effects of this level of adversity on academic instruction and are often derailed from instruction by disruption and frequent disciplinary crises. In an average school, 1-7% of the students exhibit serious levels of disruptive behaviors and disciplinary needs, while 5-15% exhibit less severe behaviors that nevertheless require considerable individual attention. In high-poverty urban schools, as much as 54% of students have been shown to fall into the upper tiers requiring intense and/or targeted services.[7] When student need is at such an overwhelming level, the high-need students become powerful negative socializing influences, contributing to disrupted learning environments, less time spent on task, and lower academic achievement for all students. Moreover, because schools are unprepared to address these needs, staff responses (such as detentions and suspensions) are often punitive or exclusionary and employed in racially-disparate ways. These practices exacerbate existing problems by creating more time out of class, promoting student disengagement from learning, and propelling students farther down the path of dropping out.[8] Finally, lacking the systems and skills to succeed, school staff become resigned and demoralized, creating a spiral of disempowerment that fuels absenteeism and turnover and further undermines efforts at reform.

High-poverty schools thus persistently fail because the problems of children living in poverty are not adequately addressed on multiple fronts: they are not adequately addressed in the community; they are not adequately addressed in the school; and they are not adequately addressed in the classroom. It therefore comes as no surprise that schools in communities with enormous stressors and scarce resources are far less likely to gain traction for reforms and develop essential supports for learning that improve student academic achievement.[9] As a group of leading researchers concluded when observing truly disadvantaged schools:

> At both the classroom and the school level, the good efforts of even the best of educators are likely to be seriously taxed when confronted with a high density of students who are in foster care, homeless, neglected, abused and so on. Classroom activity can understandably get diverted toward responding to these manifest personal needs. Similarly it can get difficult at the school level to maintain collective attention on instructional improvement when the social needs of children continue to cry out for adult attention. It is easy to see how the core work of instruction and its improvement can quickly become a secondary focus.[10]

The effects of poverty thus create a devastating cascade of systems failures in high-poverty schools. The solution, we contend, is to reverse systemic failure at its root through the redesign of high-poverty schools so that they have the capacities to tenaciously confront poverty-related barriers to teaching and learning and enable the academic success of all students.

From Model to School-Design

The avalanche of school systems failure has prompted two distinct responses among policy makers, academics, and practitioners. The first camp, led by advocates of a "Broader, Bolder Approach to Education,"[11] argues that the association between poverty and low student achievement is so powerful that polices must directly address these disadvantages in parallel to a school-improvement agenda. They thus emphasize the need for expanded community services, including early childhood education, health services, after-school programs, and extended school days. Certainly, services for students are critically important, but "service models" too often work at the fringes, fail to effect school change, and lose sight of how services must support a school's core educational mission. On the other side of the debate are entities, such as the Education Equality Project, that argue that success is only possible if schools

are held accountable for the achievement of all students, and that all decisions about staffing and resources must be made with the sole purpose of meeting students' academic needs. Proponents of this approach emphasize recruiting and equipping high-quality teachers, principals, and administrators and removing any who are ineffective. Yet, while accountability, leadership, and teaching innovation are clearly vital, they often fail to get sufficient traction because they fail to address poverty-related barriers that can derail even the most effective educators who are unprepared for the depth of challenge in high-poverty schools.[12] We therefore advocate a third approach.

Widespread, sustainable school transformation success, we argue, is only possible when a school, as a whole, has the capacities to respond to and remove poverty-related barriers to leadership, teaching, and learning; to build those capacities school-wide; and thereby create a new culture that supports excellent teaching and successful learning. This must be the work of every staff member in the school—not just a few teachers or social workers. Moreover, fundamental change in school culture and climate can serve to potentiate the other elements of successful school reform. Put simply, if a school "gets the culture piece right," it is far more likely that leaders can lead, teachers can teach, and students can learn.

The Turnaround for Children (TFC) whole-school model offers a scalable solution for high-poverty public schools that recognizes the effects of poverty on learning, teaching, and school design; addresses those barriers to learning head-on; and by doing so, builds a school culture that provides the necessary conditions for learning and academic achievement. The TFC model contends that if high-poverty schools develop this capacity—through creating school-wide systems, integrating vital community services, and building staff skills; and if this capacity-building is coupled with what we have learned from other innovative models (e.g., about effective leadership, quality teaching, extended learning, service integration, and the need for common core standards); then widespread, scalable, and sustainable system reform in our lowest-performing public schools is truly possible. Such a transformation can put our nation back on the path to achieving ESEA's original vision—where poverty is no longer a bar to learning, and a quality education offers all our nation's children an escape from poverty.

Since 2005, TFC has worked in over 60 of the lowest-performing public schools in New York City. TFC engages high-poverty/low-performing schools in a comprehensive three-year on-site intervention that transforms the school from the inside out. The intervention begins by establishing a partnership with a principal committed to addressing both academic and non-academic barriers to student success and to creating effective conditions for learning. TFC then deploys a team of highly-experienced educators and social workers—including a *Project Director, Education Coach, Classroom Coach, and Social Work Consultant*—to work with each partner school. Each TFC school augments the external team by hiring a *Student Support Social Worker (SSSW)*, who is in turn supported by highly-skilled social work interns trained by TFC. The TFC intervention focuses on building school capacity in three areas: establishing school-wide *systems*, integrating student support *services*, and building staff *skills*. Comprehensive student support *systems* are introduced through three new problem-solving teams that focus on behavior, academics and school climate. The *Student Intervention Team (SIT)* assumes care management for students at the highest level of behavioral and social need who often disrupt and derail classroom instruction and require the intervention of outside providers. The *SIT* reviews highest-risk students' needs, and develops and monitors intervention plans for in-school counseling and referral to outside services. The TFC model focuses on the most challenging students first because it recognizes that a small percentage of extremely high-need students can be so negatively charismatic that they destroy a school culture and make it

virtually impossible for teachers to teach and students to learn. As in a public health schema, identifying and intervening intensively with those at highest need or risk is critical not just for those individuals, but for the entire population of students. Indeed, when as few as 25 very powerful or disruptive students receive the help they need, the effect on the culture and morale of a school is stunning and immediate. The *Instructional Support Team (IST)* supports students whose needs are more academic in nature and can be met through school- and classroom-based resources and strategies. The *IST* identifies academically at-risk students, coordinates care and intervention strategies with staff members, and provides professional development for teachers. By doing this work effectively, the *IST* prevents inappropriate referrals to special education and ensures the continued academic progress of students who would otherwise be at risk of failure or dropping out. The final *Core Team* operates at the whole-school level and focuses on overall school safety and culture, disciplinary codes and behavioral norms, classroom practices, and family engagement. This team's mission is to create and sustain a healthy vibrant school environment.

At the same time it is establishing school-wide *systems*, the TFC model establishes pathways to student support services in the school and in the community. Each TFC partner school hires an experienced *Student Support Social Worker (SSSW)*, trained by TFC's mental health experts, who serves as a first responder for crisis intervention, counsels students, develops school-wide programs, and helps lead the *SIT*. The *SSSW* also arranges for a community-based agency to be the school's Primary Mental Health Partner, develops critical linkages between the school and community-based child-servicing systems, connects high-need students with appropriate services, and serves as a liaison between the school and families. By serving as a member of the school community, accepted and trusted by both students and families, the *SSSW* reduces issues of stigma and access.

Finally, the TFC model provides teachers and administrators with targeted training in the highly-specific, classroom-based *skills* needed for success in high-poverty schools. These skills—defusing disruption, de-escalating crises, identifying early warning signs, working with diverse learners, and mastering classroom organization and management practices—are essential but commonly lacking in standard teacher training. Providing school staff with the skills for gaining control over disruptive behaviors, and altering those behaviors, frees school leaders from constant crisis management and enables teachers to maintain orderly classrooms and spend more time on academic task.

Thus, the TFC model works at the individual, classroom, and whole-school levels and enables the entire school to organize for action against adversity. The result of the TFC intervention is a profound shift in school culture and performance. Schools characterized by disorder and violence become calm and safe. Punitive disciplinary practices are replaced with effective strategies that defuse trouble before it escalates. High-need students receive effective services, and inappropriate referrals to Special Education decrease markedly. Principals who were floundering emerge as highly-effective leaders, and teachers who were failing to connect with students spend more time on-task and blossom into successful educators. Excuses for poor performance disappear as a culture of accountability takes root throughout the school building.

This culture shift produces compelling academic and non-academic outcomes. Data from TFC elementary and middle schools in New York City in 2005-2009 showed dramatic gains in math and English scores. The percentage of students at or above math standards rose from 49% to 82% (elementary) and 24% to 64% (middle); and English language arts assessments rose from 47% to 57% (elementary) and from 27% to 49% (middle). In addition, a three-year independent evaluation of five TFC schools in 2008 showed a 51% decrease in

police reported incidents, a 32% decrease in suspensions, a 77% decrease in teacher turnover, and a 34% decrease in teacher absences. In addition, annual rates of in-school counseling rose dramatically and students in counseling self-reported less time spent with "deviant" peers, and more readiness for the social and academic challenges of high school.

Over the course of the three year intervention, a new culture emerges throughout the school, so that the intervention's effects are sustainable and "owned" by the school. Moreover, at a cost of $200,000 per school/per year the model is ripe for scale and replication. TFC's goal, however, is not simply to serve as a model program that schools may choose to adopt. Rather, success will be achieved when all high-poverty schools are mandated and designed to have the capacities in place to remove common barriers to teaching and learning and thereby establish an effective school culture for academic achievement.

Lessons from Innovative Outliers

This vision of success has been captured by a small number of schools and is supported by academic research. Valuable insights can be gained from analyses of the innovative outliers—the small but powerful number of high-performing/high-poverty schools—about what high-poverty schools need to succeed. Seminal studies of such schools, including those by The University of Chicago's Consortium on Chicago School Research[13] and Mass Insight Education and Research Institute,[14] have produced compelling evidence of the "essential elements" of highly-effective high-poverty schools. In the Chicago study, researchers identify a system of *essential supports* that contribute to success of high-poverty schools, and conclude that leadership is the driving force of school improvement, with a strong leader characterized as one adept at management, instruction, and constructive engagement of staff, students, and families. This guiding force is supported by four subsystems: instructional guidance (i.e., a demanding, coherently-aligned curriculum supported by appropriate strategies, materials and tools); professional capacity (i.e., the human capital subsystem, from staff recruitment to professional development); parent-community-school ties (i.e., teachers developing an understanding of students' backgrounds, and schools sustaining relationships with community services); and school learning climate (i.e., the establishment of safety and order, staff support, and a positive peer culture).

The Mass Insight study similarly examined the levers for success in high-performing high-poverty schools and concluded that these outlier schools "are able to generate such high achievement because they confront, in specific, comprehensive, ongoing ways, the systemic effects of poverty on their students' learning."[15] The study identifies the conditions, termed "*readiness*," that schools must possess to ensure the academic success of their students: the readiness of school leaders to act, of teachers to teach, and of students to learn. To support the conditions of readiness, schools serving high-poverty communities must have the capacity to "act against adversity" as it manifests in student needs; create a safe and orderly environment; support positive adult-student relationships; develop a strong and professional teaching staff who take responsibility for student achievement and who can effectively support the learning needs of high-poverty students; and maintain leadership that addresses problems creatively.[16]

What these and other studies have in common is an acknowledgement that solutions to underperforming schools must be comprehensive and well coordinated, and that the "essential elements" of successful transformation of high-poverty schools go far beyond narrow technical solutions related to academics alone. Moreover, these studies clearly acknowledge the critical roles of school leadership, strong professional staff, extended learning opportunities, integrated services, as well as coherent curricula aligned to effective standards, assessments, and teaching tools. These essential elements have appropriately been the focus

of many recent policy initiatives and should continue to be. A host of innovative programs, including New Leaders for New Schools (NLNS), Teach for America (TFA), Citizen Schools (CS), and Communities in Schools (CIS), have made enormous strides in bringing a number of the essential elements to bear in a number of high-poverty schools—from impactful leadership (NLNS) and effective teaching (TFA), to extended learning (CS) and service integration (CIS).

However, other essential elements identified in the Chicago and Mass Insight studies have not been as universally acknowledged and consistently pursued, an oversight particularly problematic for high-poverty schools. These primarily encompass systems of student support and the development of a productive climate for teaching and learning, including schoolwide safety and order, well-managed classrooms, supportive adult-student relationships, a prosocial peer culture, collaborative family connections, and effective use of community services. These are equally essential to school success and cannot be separated from academics. Highly-effective charters and school management organizations—such as Mastery Charter Schools, AUSL, KIPP, Green Dot and Friends of Bedford—provide isolated examples of whole-school approaches that produce high academic achievement and successfully incorporate the essential element of creating a profound school culture shift that establishes effective conditions for learning. However, high-performing charters and school management organizations reach only a small percentage of high-poverty students. The remainder of charters fare no better than public schools in academic achievement; and even highly-effective charters sometimes yield the unintended consequence of increasing concentrations of English language learners and Special Education students in already-over-stressed public schools. Thus, notwithstanding these remarkable programs, the problem remains that the vast majority of high-poverty public schools are left untouched and millions of children are left undereducated.

Implications for High-Poverty School Reform Policy

While this paper offers the TFC model as an example of an intervention that can transform persistently failing schools, the larger opportunity is to design all schools in high-poverty communities to succeed by ensuring that they have the systems, services and skills necessary to meet the needs of the students and families they serve. Increased understanding of the relationship between the effects of poverty and school failure, and the nature of effective responses, suggests the following policy recommendations:

1. Mandate the incorporation of systems of support, culture change, and service integration into all reform options (transformation, turn-around, alternative management, and restart) for high-poverty schools and school districts.

2. Invest in the scaling of models that address systems of support, culture change, and service integration in high-poverty schools.

3. Fund school-centered services for high-poverty students and: (1) institutionalize the role of a school-based clinical social worker; (2) improve funding for evidence-based prevention and intervention strategies (e.g., counseling) that can preempt more expensive mental health interventions and Special Education classification; and (3) improve the integration of schools and child-serving systems by expanding public funding streams to cover current funding gaps (e.g., for case management, crisis intervention services, family outreach, and teacher consultation).

4. Provide adequate funding for interventions for children with intense needs (e.g., autism, developmental disabilities, and severe mental health issues).

5. Promote the development of student support and climate measures that can be incorporated into accountability systems, and establish incentive structures that promote the adoption of school culture and climate improvement models.

6. Establish standards and provide funding for leader and teacher preparation that addresses poverty-related barriers in high-poverty schools.

If our national education system is to fulfill the promise of providing a quality public education *and* an escape from poverty, then we must seriously address the poverty-related bars to learning that are preventing our schools from leading the way out.

Endnotes

1. Dr. Pamela A. Cantor is President, CEO, and Founder of Turnaround for Children (TFC); Deborah S. Smolover is TFC's Vice President for Public Policy; and Joan K. Stamler is TFC's Vice President for Metrics and Research.

2. Public Papers of the Presidents of the United States, U.S. Government Printing Office, (1965), Lyndon B. Johnson, Book I (1963-1964): 704-707.

3. Goldin, C. & Katz, L. (2008). *The Race between Education and Technology.* Cambridge, MA: The Belknap Press of Harvard University Press.

4 United States Department of Education. (2008) "Mapping America's Progress" http://ed.gov/nclb/accountatibility/results/progress/nation.html. ("Underperforming schools" are defined as those failing to make adequate yearly progress (AYP).

5. U.S. Government Accountability Office. (2007) *No Child Left Behind Act: Education Should Clarify Guidance and Address Potential Compliance Issues for Schools in Corrective Action and Restructuring Process.* Washington, D.C.: GAO-07-1035.

6. Department of Health and Mental Hygiene. (2002-2003). Survey of Pediatric Mental Health Services and Capacity in New York City.

7. Baker, J. A., Kamphaus, R.W., Horne, A.M., & Winsor, A.P. (2006). Evidence for Population-Based Perspectives on Children's Behavioral Adjustment and Needs for Service Delivery in Schools. *School Psychology Review,* 35(1), 31-46.

8. Osher, D., Sprague, S., Axelrod, J., Keenan, S., Weissberg, R., Kendziora, K., & Zins, J. (2007). *A comprehensive approach to addressing behavioral and academic challenges in contemporary schools.* In J. Grimes & A. Thomas (Eds.), *Best practices in school psychology* (5th ed.; pp. 1263–1278). Bethesda, MD: National Association of School Psychologists.

9. Bryk, A.S., Sebring, P.B., Allensworth, E., & Easton, J.Q. (2010). *Organizing Schools for Improvement: Lessons from Chicago.* Chicago: The University of Chicago Press.

10. Bryk et al., 2010 at 173.

11. Economic Policy Institute, "A Broader, Bolder Approach to Education, 10 June 2008, http://www.boldapproach.org/statement/.html (20 March 2009)

12. Kahlenberg, Richard. *All Together Now.* Washington, D.C.: Brookings Institute Press, 2001.

13. Bryk et al. 2010

14. Calkins, A.; Guenther, W., Belfiore, G. & Lash, D. (2007). "The Turnaround Challenge: Why America's best opportunity to dramatically improve student achievement lies in our worst-performing schools." Boston: Mass Insight Education & Research Institute.

15. Calkins, et al., 2007, p. 21.

16. Calkins, et al,. 2007

The Challenge of Innovation for a 21st Century Teacher Workforce: New Directions for Federal Policy

Raymond L. Pecheone, Ph.D., and Ann Jaquith, Ph.D.
Stanford University

Introduction

Technology and digital media offer a variety of tools that have the potential to transform how teachers teach and students learn. In some classrooms and in some schools, educators are experimenting with this possibility by using technology to alter how and what students are asked to learn. In these places, technology is already expanding the ways in which students can show their thinking, build knowledge and create solutions. Such schools are strong examples of how technology can help transform practice, although they are rare.

More common in today's schools, as is apparent to anyone who has recently set foot in schools, is the digital divide that exists between how technology typically is used in-school—to find information or to collect and sort data—compared to how technology is often used outside of school—to connect networks of people who share interests and ideas, to mobilize people into action quickly, to create simulated environments to test theories and try out ideas or to build and design innovative products and services. The in-school/out-of-school digital divide is vast and growing.

Therefore, the question must be asked: what would it really take to use technology to its full potential in the nation's schools and for technology to transform the way learning occurs? In many classrooms, computers are mostly used as typewriters with memory and spell-check functions and the internet is merely a digital library. What must be done to ensure the use of technology in schools beyond simply gathering and transmitting information? The vast array of technology tools—computers, ipads, cell phones, MP3 players, social networking sites and "game" software and the internet, itself, with its abundance of online resources like Academic Earth, which offers free access to videos and lectures from leading scholars at universities like MIT and Yale—are infrequently used by teachers in our schools to engage students in thinking and problem solving. Instead in education, we still largely think about technology and about learning in an "information-centric" way as Mitchel Resnick of MIT warns us. Resnick says, "If we use computers simply to deliver information to students, we are missing the revolutionary potential of the new technology for transforming learning and education."[1]

New approaches to learning, teaching and assessing learning are needed

To realize the revolutionary potential of new technology to transform learning and education, teaching and learning must be fundamentally reconceptualized as processes that emphasize thinking, problem-posing and knowledge creation. Technology needs to be woven into these news approaches. The way states approach the assessment of teachers and students can have a great deal of impact on

developing these new approaches for making thinking and creating central to the educational experience of students in all of our classrooms, both urban and rural, from Maine to Arkansas, from Miami to Fresno.

How assessments can help reshape instruction

Over the past decade, for better and worse, the relation between high-stakes assessment and instructional practices has been tightly aligned, leading to the common refrain that what gets tested gets taught. As educators, policy makers, and the public have begun to forge a consensus that the nation's public schools must focus on better preparing all children for the demands of citizenship in the 21st century, states have developed standards-based educational systems and more systematic testing of basic knowledge. These tests have had a strong influence on the curriculum in today's schools and on the way instruction is delivered. Most of these tests are multiple choice, "on demand" standardized measures of achievement, which limit test content to a narrow range of knowledge and skills. Consequently, the range of classroom curricula has narrowed and the practice of answering questions with one right answer has increased.

Studies have documented a number of unintended and undesirable consequences of these types of narrow assessments, especially when strong consequences are attached to the scores. Such undesirable consequences include: 1) a narrowing of the academic curriculum and the range of learning experiences for students, especially in schools serving lower-achieving children; 2) a focus on recognizing correct answers to lower-level questions rather than on developing higher-order thinking and reasoning skills or learning how to construct an argument or design and test a hypothesis; 3) an increased emphasis on test-taking strategies; and 4) a dissatisfaction with the overall school experience by many parents and educators. A similar point was made by Achieve, a national organization of governors, business leaders, and education leaders, when it called for a broader view of assessment:

> States … will need to move beyond large-scale assessments because, as critical as they are, they cannot measure everything that matters in a young person's education. The ability to make effective oral arguments and conduct significant research projects are considered essential skills by both employers and postsecondary educators, but these skills are very difficult to assess on a paper-and-pencil test.[2]

The past decade has clearly demonstrated that the nature of the high-stakes test will wield an enormous influence on instructional practice.

The design of the test is the problem

Currently, in the United States the design of student assessments do not invite students to deliberate or construct arguments or to think deeply about a topic over time. U.S. tests rely primarily on multiple-choice items that evaluate students' ability to recall and recognize discrete facts. Examinations in most high-achieving countries, however, primarily use open-ended items that require students to analyze, apply knowledge, and write extensively. Not surprisingly, in these nations the growing emphasis on project-based, inquiry-oriented learning has led to an increase in the use of school-based tasks that are embedded into the curriculum, such as research projects, science investigations, the development of products and reports or presentations about their efforts. These tasks influence the day-to-day work of teaching and learning and focus daily instruction, for example, on asking questions and using knowledge to solve meaningful problems. Assessments that promote student thinking, intellectual creativity and discourse and that reveal evidence of understanding as it develops over time are needed in this country. These types of assessments have the potential to redirect and transform today's approach to teaching and learning.

Leveraging improvements in teaching and teacher evaluation

One of the few areas of consensus among policy makers, practitioners and the general public is that improving teacher quality is one of the most promising strategies for improving public education outcomes in the United States. Furthermore, this strategy is particularly critical for groups of children who have historically been taught by the least-qualified teachers.

However, existing policies for defining and measuring teacher quality rely almost exclusively on classroom observations by principals that differentiate little among teachers and offer minimal useful feedback, or they rely on teachers' course-taking plus paper-and-pencil tests of basic skills and subject matter knowledge, which are poor predictors of later effectiveness in the classroom. In a recent study, the failure of evaluation systems to provide accurate and credible information about teacher competence concluded that 99% of practicing teachers are judged to be satisfactory or above, and 94% of the teachers receive exemplary evaluations; this outcome in evaluation has come to be called the Widget Effect[3]. Current systems of evaluation of teaching neither measure instructional efficacy nor do they encourage stronger teacher education and development programs that can improve teaching quality.

It has become clear that new strategies for evaluating and developing teacher competence and effectiveness are needed. For the immediate future any serious and systematic effort to improve the quality of teachers must include the development of reliable and valid measures of how well teachers perform in the classroom, linked to evidence of their effectiveness in promoting learning for all students. Moreover, given the rapid evolution of new digital possibilities, the nature in which teachers are prepared and supported should foster significant changes in teachers' ability to use technology in ways that will improve instructional practice and learning outcomes.

What are some promising directions in supporting and evaluating teacher quality?

Establishing common standards for effective teaching and accountability for professional educators is a key leverage point for transforming today's education system. Equally important is the recognition that the profession has not come to terms with an agreed upon knowledge base that includes a common set of knowledge and skills (powered by technology) that are universally understood, communicated and enforced.

One of the most powerful examples of a valid and credible performance-based approach to assessing teachers was first developed through the work of the National Board for Professional Teaching Standards (NBPTS), which developed standards and assessments for evaluating accomplished teaching. These assessments examine teachers' practice through videotapes of teaching, lesson plans, and evidence of student learning. Many studies have found that the NBPTS assessment identifies teachers who are more effective in raising student achievement than their peers.[4] In addition, participating in the certification process has been found to improve teachers' performance—thus developing, as well as measuring, good teaching.[5] However, National Board Certification is reserved for experienced teachers, and until recently, there was no comparable assessment for beginning teachers that could evaluate who is ready to teach and likely to be effective. Although teacher-licensing tests, which are usually multiple-choice tests of basic skills and subject matter knowledge, are now used in nearly all states, these tests are not predictive of teachers' abilities to effectively teach children. Moreover, in many cases these tests evaluate teacher knowledge *before* teachers enter or complete teacher education, and hence are an inadequate accountability measure to assess both teaching skills and the quality of teacher education programs.

Moving the field forward, several states, including California, have created performance

assessments for initial licensing of prospective teachers patterned after the approach used by the NBPTS. These measures of performance have been found to be strong levers for improving preparation and mentoring, as well as determining teachers' competence. These assessments require prospective teachers to: 1) complete their student teaching or internship and to document their plans for a unit of instruction tied to student standards; 2) adapt unit plans for special education students and English language learners; 3) videotape, analyze, and adapt their lessons; and 4) collect and evaluate evidence of student learning. Like the National Board assessments, beginning teachers' ratings on these kinds of assessments have been found to predict their students' value-added achievement on state tests[6] and to improve the quality of their teaching. Furthermore, the process improves the quality of teacher education because programs must ensure that their candidates can perform all of the required tasks, and these tasks constitute essential features of effective instruction. Schools of education also get feedback about the performance of all of their candidates in relation to teacher candidates at other institutions in the state.

After decades of inattention to teacher performance, where the evaluation of teachers was essentially a local control issue shaped by unions, there now appears to be a growing consensus by the federal government and states to put policies in place to develop a rigorous, accurate and credible system of teacher accountability that is explicitly connected to providing evidence of a teachers' impact on student learning. To underscore this point, the Race to the Top (Rtt) competition has been a major catalyst for initiating this transformation by challenging states to develop a comprehensive plan for teacher support and accountability that spans the full range of a teacher's career, from preparation to Board certification and beyond. These state plans include provisions to systematically change the expectations of assessing effective teaching across all levels of education focusing on preparation (initial license), induction and tenure (professional license), teacher evaluation as well as the creation of competency-based systems that use strategic compensation to reward high performing teachers. See Figure 1 for a graphic representation of the four core components of a possible accountability system that is being discussed by states to meet the requirements of Rtt.

Having a coherent system of teacher evaluation across the career continuum, however, is not enough to ensure that technology-based learning and assessment will become a core competency in recruiting, preparing, retaining, developing, rewarding and attracting top talent into the teaching profession. These changes require a fundamental shift in traditional state roles to develop an aligned and transparent system of policies, tools and regulations that will enable districts and schools to focus on developing human capital. Furthermore, a fundamental shift is also needed in the standards that are adopted around effective teaching that embraces 21st century learning goals powered by technology. Digital technologies can be the catalyst for making this possible because technology enables teachers to document and gather evidence of how students learn in real time.

Assessments that promote and reveal thinking

Performance assessments provide strategically designed windows into teachers' instructional practice—including teachers' instructional design and assessment practices—to illuminate teachers' thinking about evidence of student understanding as demonstrated by teachers' instructional choices and actions. For instance, in these assessments teachers are asked to identify the purpose of a lesson and to consider how effectively the planned, as well as enacted, instructional activities work to develop students' understanding of a particular concept or skill. Additionally, teachers are required to consider how they will determine if students have understood the lesson's concept or instructional

objective. Teachers are asked to consider what counts as evidence of a student's understanding and if that evidence is sufficient and what the evidence implies for future instruction. This type of assessment seeks to make visible the range of decisions or choices that a teacher makes before, during and after instruction in order to provide the sort of rich and patterned information to a teacher from which she can learn how to make better or more purposeful choices in the future.

Just as learning-centered assessments that also illuminate moments and patterns of learning are desirable for their potential to improve teaching and teacher education, they are also desirable for enhancing student learning. As a genre, performance assessments (for teachers, students and principals) have the potential to provide the kind of information that shows "whether students are in a position to continue learning and growing" since performance assessments endeavor to make thinking processes—which can be complex and multifaceted—visible over time.

Citizens, educators and students all recognize that in life, as opposed to the artificial and sequestered world of the classroom, people are typically required to apply their understanding of multiple concepts to unfamiliar situations much of the time. The real world requires continuous learning in context. Indeed, this is the process of sense-making. This sort of challenge of knowing and doing or making sense of something is what the 21st century skills aim to cultivate. As with performance assessments for teachers that seek to make teachers' own thinking about their instruction visible, so too must the next generation of assessments for learning also endeavor to make students' thinking visible by uncovering students' thinking processes as well as their depth of understanding. The next generation of teacher and student assessments not only need to be more performance-based, but they also should expose the sort of choices that students or teachers make as they are thinking through an approach to a problem.

How performance assessment works with technology

Because performance assessments require a "performance"—they involve the "doing" of "something"—the person engaged in a performance assessment becomes involved in putting his knowledge and skills into purposeful action, which provides an opportunity for the doer to demonstrate the ability to "think with" a particular set of knowledge and skills. If the circumstances of the performance are unfamiliar to the participant, then an opportunity is created that demands the doer to think flexibly with his knowledge and skills. This sort of situation simulates a more authentic context in which participants are learning during the assessment. Schwartz and Arena among others propose that learning-centered assessments are both missing and needed. They identify several shortcomings of the current assessments, such as their focus on knowledge that is "isolated" from action and on knowledge that is "retrospective" in nature, which means that the assessment functions more like an autopsy on what was learned rather than as a checkup on how learning is going and where adjustments are needed. From this perspective, current assessments sequester students "from learning opportunities and outside resources that might contaminate the validity of the assessment."[8] Such assessments are not in service of learning.

Assessments that are integrated into the curriculum can illuminate learning and are the sort of assessments that can reframe the nation's approach to teaching and learning and make it possible to realize the revolutionary potential of technology to transform education. For instance, Schwartz and Arena argue for "choice-adaptive" assessments, which are assessments in which the learner and the environment adapt to one another; the learning environment adapts to the "students' choices to help guide them to better choices" for learning and the student also makes "choices among the available options… [as a way to] learn to become more flexible and effective in learning."[9] Advances in technology

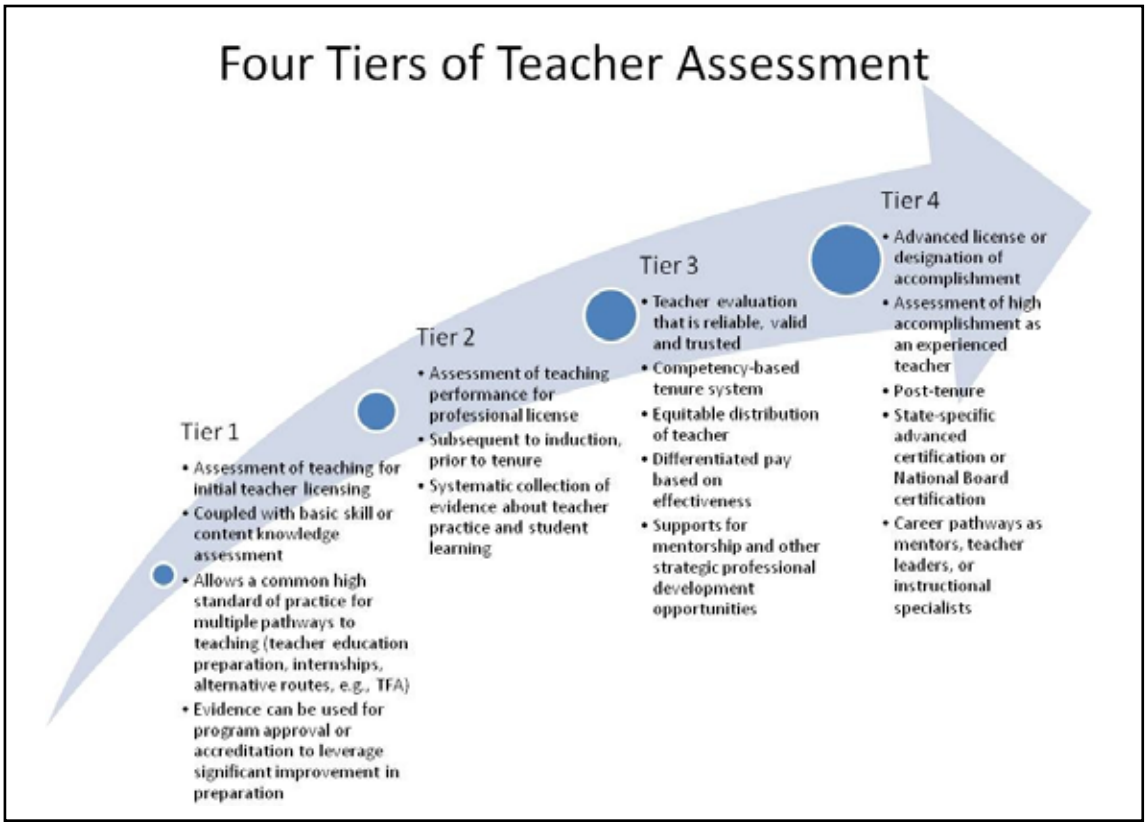
make choice-based assessments feasible and they argue that "choice" and the identification of patterns in choice making is a useful construct for illuminating patterns of thinking and approaches to learning that can link instruction and assessment in useful ways by providing real-time feedback to students and teachers and by avoiding suspending instruction in order to administer assessments.

What is needed is to make the transition from an "analog" and linear approach to teaching and learning to a "digital' conception of learning that is multidimensional and integrative.

New technologies can enhance and transform the way the assessment processes are developed, delivered, and used. Technology can provide adaptive tools and access to information resources for students to demonstrate their thinking and learning, and technology can facilitate and improve the communication of appropriate feedback to support teacher scoring and computer-based scoring (now possible for both selected response and some forms of constructed-response items). By using technology to reduce costs for the delivery, scoring, and reporting of more open-ended assessment formats, resources can be reinvested in other improvements.

Summary

New national policies promoting common core standards and accountability for students and teachers (i.e., Rtt and Title 1 reauthorization) will have a major impact on how curriculum, instruction and assessment are practiced in this country. While technology has the potential to revolutionize teaching and learning, technology alone does not guarantee advances in learning or transformational change in education. Aligning testing policy with technological advances in teaching and learning is essential if these policies are to have any chance to transform education in the 21st century.



An added challenge is the state of the economy. Reduced revenues are producing significant cutbacks at all levels of the system for the foreseeable future. Therefore, investments in education and technology must be both cost-effective and strategic. Can states afford the investment? Education is the engine of America's economic growth and prosperity. Preparing citizens to compete and thrive in the global economy is a national necessity. The nation cannot afford to skimp in providing the type of education that will cultivate the thinkers and creators of tomorrow. Technology needs to be a significant part of that investment.

Endnotes

1. Mitchel Resnick (2002). Rethinking learning in the digital age. In *The Global Information Technology Report: Readiness for the Networked World*, edited by G. Kirkman. Oxford University Press. 32.
2. American Diploma Project (2004). Proposal for the Bill & Melinda Gates Foundation. Achieve, Inc.
3. Daniel Weisberg, Susan Sexton, Jennifer Mulhern, & David Keeling (2009). The widget effect: Our national failure to acknowledge and act on differences in teacher effectiveness. *Education Digest*, 75(2), 31-35.
4. See for example, L. Bond, T. Smith, W. Baker, & J. Hattie (2000). The certification system of the National Board for Professional Teaching Standards: A construct and consequential validity study (Greensboro, NC: Center for Educational Research and Evaluation); Cavaluzzo, L. (2004). Is National Board Certification an effective signal of teacher quality? (National Science Foundation No. REC-0107014). Alexandria, VA: The CNA Corporation; Goldhaber, D., & Anthony, E. (2005). Can teacher quality be effectively assessed? Seattle, WA: University of Washington and the Urban Institute; Smith, T., Gordon, B., Colby, S., & Wang, J. (2005). An examination of the relationship of the depth of student learning and National Board certification status (Office for Research on Teaching, Appalachian State University). Vandevoort, L. G., Amrein-Beardsley, A., & Berliner, D. C. (2004). National Board certified teachers and their students' achievement. *Education Policy Analysis Archives*, 12(46), 117.
5. Mistilina Sato, Ruth Chung Wei, & Linda Darling-Hammond (2008). Improving Teachers' Assessment Practices through Professional Development: The Case of National Board Certification, American Educational Research Journal, 45: pp. 669-700; Tracz, S.M., Sienty, S. & Mata, S. (1994, February). The self-reflection of teachers compiling portfolios for National Certification: Work in progress. Paper presented at the Annual Meeting of the American Association of Colleges for Teacher Education. Chicago, IL; Tracz, S.M., Sienty, S. Todorov, K., Snyder, J., Takashima, B., Pensabene, R., Olsen, B., Pauls, L., & Sork, J. (1995, April). Improvement in teaching skills: Perspectives from National Board for Professional Teaching Standards field test network candidates. Paper presented at the annual meeting of the American Educational Research Association. San Francisco, CA.
6. Mark Wilson & P.J. Hallum (2006). Using Student Achievement Test Scores as Evidence of External Validity for Indicators of Teacher Quality: Connecticut's Beginning Educator Support and Training Program. Berkeley, CA: University of California at Berkeley.
7. Daniel L. Schwartz & Dylan Arena. Choice-based assessments for the digital age. August, 2009. Unpublished manuscript.
8. Schwartz & Arena, p. 7
9. Schwartz & Arena, p. 29

Transforming America's Education Through Innovation and Technology

CONFERENCE PARTICIPANTS

August 16-21, 2010

Members of Congress

Representative Tom Cole
and Ellen Cole
Representative Susan Davis
and Steve Davis
Representative Bob Etheridge
and Faye Etheridge
Representative Sam Farr
and Shary Farr
Representative Maurice Hinchey
Representative Rush Holt
and Margaret Lancefield
Senator Richard Lugar
and Char Lugar
Representative George Miller
and Cynthia Miller
Representative David Obey
and Joan Obey
Representative Ed Pastor
and Verma Pastor
Representative Donald Payne
and William Payne
Representative Lucille Roybal-Allard
and Edward Allard
Representative Pete Stark
and Deborah Stark
Representative Mel Watt
and Eulada Watt
Representative Henry Waxman
and Janet Waxman
Representative Lynn Woolsey

Scholars/Experts

Michele Cahill
Carnegie Corporation of New York

Pamela Cantor
Turnaround for Children

Louis Gomez
University of Pittsburgh

Michael Horn
Innosight Institute

Barbara Means
SRI Institute

Raymond Pecheone
Stanford School Redesign Network

Foundation Representatives

Leah Hamilton
Carnegie Corporation of New York

Andrés Henríquez
Carnegie Corporation of New York

Darren Walker
The Ford Foundation

Aspen Institute Congressional Program Advisory Committee

Adele Simmons

Moderator

Dick Clark
Director, Congressional Program
The Aspen Institute

Rapporteur

Carol Copple

Aspen Institute Staff

Diane Anello
Bill Nell
Carrie Rowell
Pat Walton

Transforming America's Education Through Innovation and Technology

CONFERENCE AGENDA

August 16-21, 2010

How Innovation Can Transform American Schools and the Way Students Learn

Michael Horn, Innosight Institute

Horn argues in his 2008 book, co-authored with Clay Christensen, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns*, that complacency has held back educational progress and only courageous jolts to the system, often employing models proven successful in the business world, can help bring about revolutionary change.

Discussion Questions

- What is "disruptive innovation" and how is it different from the kinds of change that characterize American education? Is it primarily a function of new technologies, new approaches to problem-solving, and other factors?
- What can motivate a school system to make bold changes to overturn the status quo?
- Has innovation already led to improvements in other countries?
- What are the challenges in applying business models to the education sector?

The Power of Technology for Transforming Teaching and Learning: Implications for Federal Policy

Louis Gomez, University of Pittsburgh

The recent transformations in society that have led to a personal computer in most homes, and near universal use of the Internet, cell phones, and hand-held electronic devices were unimaginable 20 years ago and now are considered basic ingredients in modern life. Technology use is widespread in education for purposes of data management and accountability and increasingly present in innovative ways in instruction. Education has the potential to utilize these tools and technologies to change the teaching and learning process to improve student achievement if policy makers can imagine transformation beyond the traditional framework.

Discussion Questions

- What does the explosion of technology imply about the 19th century model of a classroom?
- What are the key teaching and learning challenges in today's schools where technology is enabling new solutions? What does technology imply about new roles for teachers? In what ways do new technologies and applications challenge traditional instructional methods? What's most promising? What have been barriers to adoption in the past and currently?
- What is happening with teaching and learning and technology in the after-school and informal education area—museums, science institutes, etc?
- Is there a view that increasing use of technology (and spending on technology) will result in the need for fewer teachers? If so, what are the issues?
- Is the model of distance learning, via the Internet without formal classrooms, coming to the American high school? If so, is that positive or negative?
- Is there a political cost to investing in technology instead of teachers? Is it an "either/or" choice, or do they complement one another?
- What kinds of skills do/will teachers need to make use of the most promising technologies for instruction? Can technology help increase teacher collaboration?
- What are the implications of successful innovations for traditional schools of education at American universities, and how can these institutions quickly adapt to new trends?
- Where will the resources come from for these new investments?

An Overview and Demonstration of Promising New Technologies and Implications for Federal Policy

Barbara Means, SRI Institute

Several technological innovations will be explained and demonstrated to illustrate their educational impact.

Discussion Questions

- What are examples of new technologies that can help: 1) teachers; 2) students; 3) parents; and 4) administrators? How can technology be applied to link all four to better help students? Is new technology needed most in the central offices or in the classrooms, to manage data or to inspire students?
- How can school systems leverage the power of technology for assessment and continuous improvement of student learning?
- What are the steps that need to be taken to improve the nation's technology infrastructure for learning?
- How can a school district assess when it gets a good return on its technological investment?
- Have schools and districts incorporated technology in their design of teaching and learning? What are examples that have been particularly successful?

Innovative Designs for Overcoming America's School Dropout Problem and Turning Around Failing Schools: Policy Opportunities and Challenges

Pamela Cantor, M.D., Turnaround for Children

The nation has at least 5,000 schools that are persistently low-performing; these schools seem impervious to improvement strategies that have worked elsewhere; at the high school level these have been called "dropout factories." There is growing interest in "new models and new designs" for these schools that are innovative in the organization of the school, how teachers are recruited and supported, how external partners with expertise in social and family support are integrated into the school, and how teaching and learning is intensified in use of time and technology. These models require policy flexibility to be fully implemented and offer promise for tackling America's most intractable K-12 education problems.

Discussion Questions

- What are some of the innovative approaches that are being taken to address the persistent, low performance of many schools where the student body has a very high-poverty rate—with often more than 60% eligible for free lunch and where students are significantly under-achieving?
- What are the promising results? What are the key factors that these new models have in common? Do they have any elements that are policy-related, for example, with a connection to accountability measures or to flexible use of public dollars?
- How does family support and attention to socio-emotional learning work in these models? How are teachers supported differently? Is there a difference in the use of professional development (Title II funds)? Is there a difference in the use of data by teachers that is facilitated by technology? If so, how does this work?
- What are the barriers to bringing the most promising of these models to scale? What are the opportunities for incentivizing or facilitating this through federal policy, both in education policy and in other spheres such as health and human services?

The Challenge of Innovation for a 21st Century Teaching Workforce: New Directions for Federal Policy

Ray Pecheone, Stanford School Redesign Network

Teaching has always adapted to technological developments, yet the recent pace of change is hard to keep up with when governance and funding structures remain stagnant. Can national policy help leverage use of technology to increase educational effectiveness?

Discussion Questions

- How can teachers quickly learn new technologies and innovative approaches to teaching? Can teachers learn new approaches "on-the-job" or will extensive professional development be required?

- Is the potential impact of innovation and technology greater in rural or urban areas, and do any distinctions have implications for national policy?
- In this recessionary climate, can schools afford to experiment with new approaches? Can they afford not to?
- Can technology be used to transform pre-service and in-service education?
- What are the impacts for assessment and testing?