

Teachers in the Age of Digital Instruction

▪ *By Bryan C. Hassel and Emily Ayscue Hassel, Public Impact**

As digital learning has grown in prominence, a predictable debate has emerged: Teacher-union officials worry that online learning, educational software, video delivery, and other forms of technology-enabled instruction will be used primarily to replace teachers in a quest to save money. An article on the National Education Association’s website entitled “Laptops are Not Teachers” quotes Idaho Education Association president Sherri Wood criticizing an Idaho education-reform law that will give high school students laptops beginning in 2015. The law “trades teachers for technology,” she says. “You simply cannot replace a teacher with a laptop.”¹

Yet it’s not only union officials fueling teachers’ fears. Digital advocates and the media also stoke the fire. “Just as the Internet replaced telephone operators and the nightly news anchor as the default source of information,” writes Gregory Ferenstein in the magazine *Fast Company*, “teachers may be next on the chopping block.”²

We have little doubt that the digital future will transform education, but we don’t believe it requires an either-or decision between technology and teachers. Rather, digital education needs *excellent* teachers *and* the teaching profession needs digital education.

As digital tools proliferate and improve, solid instruction in the basics will eventually become “flat”—available anywhere globally. The elements of excellent teaching that are most difficult for technology to replace will increasingly differentiate student outcomes.

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In the digital future, teacher effectiveness may matter even *more* than it does today, as these complex instructional tasks are left to the adults responsible for each student’s learning. Teachers who nurture motivated, tenacious problem solvers while using new technologies to reach more children can become the fuel of local, state, and national economies. Schools will not need as many teachers as we know them. But excellent instructors, many in new roles, will need the right technology and instructional supporting teams to achieve excellence at scale, within budget, and potentially for much higher pay than today.³ The selectivity and prevalence of these excellent teachers-in-charge who will leverage technology—and be leveraged by it—will be the distinguisher of learning outcomes among schools and nations.

In order to achieve this potential in the United States, myriad policies affecting teachers—from professional development to compensation—will need to be revamped. This paper outlines how.

The Digital Revolution and Excellent Teachers Need One Another

Even as the content of digital instruction improves, accountable adults will remain critical to student outcomes. Digital fare will eventually accomplish much of the diagnosis of learning levels and provision of matching instruction, particularly in core knowledge and skills, that today distinguish excellent teachers from peers. But successful teaching is much more than delivery of core instruction, no matter how effective. It also involves the following:

- motivating students to take on next challenges and persist despite barriers;
- helping students with time and task management and other habits critical to success;
- building children’s social and emotional skills and fortitude;
- mentoring and modeling life skills;
- addressing personal and family situations that may impede learning;
- helping students dig deeper into material and develop higher-order thinking skills (analytical, conceptual, and creative); and
- taking responsibility for ensuring learning outcomes by making changes when a student’s learning growth stalls—below or above standards.

These distinguishing aspects of teachers who produce outstanding learning results with more students are not ones that technology can fully replace. At

the same time, in order to become a profession in which excellent teachers are rewarded and may reach more students over time, the teaching profession needs the digital-learning revolution. Digital learning has the potential to transform teaching in three primary ways, detailed in the pages that follow:

- **Enabling excellent teachers to reach more students.** Great teachers will increasingly be able to teach more students in person as digital learning replaces portions of instruction in an individualized fashion and provides time-saving student data; reach students remotely via technology; and capture and share their performances and methods widely through video and smart software that individualizes learning.⁴ Even among excellent teachers, various people will thrive in different roles.
- **Attracting and retaining more of these excellent teachers.** As excellent teachers reach more students, they will be able to earn more out of regular per-pupil funds. The combination of higher pay and career opportunities made possible by digital learning will, in turn, help teaching attract and keep the best performers.
- **Boosting effectiveness and job options for average teachers.** Average teachers will benefit as digital technology and the extended reach of their excellent peers take complex tasks off their to-do lists, enabling them to focus on the parts of teaching at which they can excel. Through technology, they can also obtain real-time data and advice about how to help each of their students succeed, saving time and improving performance. Digital learning makes it easier to personalize instruction, which many average teachers find difficult or impossible to achieve with whole classrooms of students with a wide array of needs. Some new roles will pay less, but many will also require hours far shorter than today's typical fifty-hour teacher workweek.⁵

To be sure, not all of today's teachers will benefit from these transformations. In all likelihood, these changes will mean that the nation needs fewer teachers as we now know them—fully and solely accountable for whole classrooms of children. Today's ineffective teachers can be replaced by more effective ones in this new digital-learning world, either through remote instruction or the extended reach of more effective teachers to more students. Those ineffective teachers who still wish to remain in education may find new roles available. But the new roles that are instructional, such as tutoring small groups, will be better filled by

today's average teachers, rather than the least effective ones. Some new roles, such as online-learning lab monitors who do not provide instructional support, may be appropriate for today's less effective teachers. But in many cases, new sector entrants who have digital hardware and software know-how will fill these roles.

The net effect is likely to be a smaller, but much stronger and more highly paid, teaching force coupled with new, lower-paid roles—many with appealing, shorter hours—that support the fully accountable teachers. This differentiated structure is similar to that which has emerged with changing roles and technology in other professions like law and medicine.

Employing digital technology to transform the teaching profession in ways that benefit students holds enormous promise. That promise will likely go unrealized, however, without significant changes in public policies and management systems, in the allocation of funds, in the technology infrastructure, and, perhaps most importantly, in the level of will and demand for better student outcomes. Here we outline a vision for how these changes can be realized.

Extending Great Teachers' Reach

We know the quality of instruction students receive makes a huge difference in their achievement. Having teachers in the top 25 percent of effectiveness versus the bottom 25 percent would enable the average low-income child to make up the typical achievement gap in just three to four years.⁶ Consecutive excellent teachers also can help middling students leap ahead. Yet we also know that given the way schools generally work today, with one teacher assigned to each classroom, only about 25 percent of classes will have one of these top-tier teachers at a given time. The other 75 percent will not.

As we have argued elsewhere, one promising strategy to change those numbers is to extend the reach of excellent teachers to more students, paying these teachers more, and attracting and keeping more of them—while still remaining within budget.⁷ States, districts, and schools are beginning to deploy more-comprehensive systems to determine teacher effectiveness. As those systems improve, education leaders will know with more certainty and in more subjects and grades which teachers are achieving the strongest results. Schools can move to identify the best teachers more rapidly, rather than waiting for systems that better allow for legally defensible dismissals.⁸ With better

evaluation, the opportunity to leverage great teachers to help more students will grow significantly.⁹

Some ways of extending excellent teachers' reach do not require technology. For example, schools could shift a few more students into better teachers' classrooms or put teacher-leaders in charge of multiple classrooms. But the digital revolution can extend great teachers' reach much further, in three ways: replacing a portion of instructional work with digital tools, interacting with more students remotely by removing some noninstructional tasks, and instructing students "boundlessly" via video and smart software that personalizes learning.

New Roles for In-Person Teachers

Even in the digital age, in-person teachers remain critical. Because of the child-care function school plays in our economy, most children will continue to attend brick-and-mortar schools. Their in-person teachers, and other school personnel, will be responsible for motivating them, teaching them time management, addressing social and emotional issues that affect their learning, and making changes when their learning stalls. In-person teachers also will be best positioned, at least in the near future, to develop students' higher-order thinking: their ability to apply knowledge and skills to analyze challenging problems, grasp broader concepts, and devise new ideas and solutions.

But time is a critical constraint for this type of educator. With only so many hours in the day, even the best face severe limits on the number of students they can reach. The promise of digital technology in this context is its ability to *free excellent in-person teachers' time* using what we call "time-technology swaps."¹⁰ In this model, digital instruction takes over a portion of great in-person teachers' instructional duties, such as delivering lectures and assessing students' mastery of standards. This frees teachers' time—allowing fewer (and better) in-person teachers to reach more students with the personalized, enriched portions of their instruction.¹¹

These swaps involve fundamental restructuring of the school day: using digital instruction specifically for the purpose of freeing enough hours of great teachers' time to work with a significant number of additional students—not just layering available technology atop current education-delivery models. Students spend 25 percent or more time with digital instruction, most likely focused on knowledge and skill acquisition. Adults still supervise students during this time, but they do not need to be teachers as we know them. Indeed, many will not be.

Numerous schools have begun using digital instruction for time-technology swaps, many of them described in Innosight Institute’s *Rise of K–12 Blended Learning* profiles.¹² Here are two examples:

- *Rocketship Education*. In this California-based charter school network’s elementary schools, students spend 25 percent of their time in a “learning lab,” receiving self-paced digital instruction and live tutoring monitored by paraprofessionals. Because this frees teachers’ time, three teachers are able to reach a total of one hundred students, rather than just seventy-five, in rotating classes of twenty-five students at a time.
- *KIPP Empower*. In this Los Angeles K–8 charter school, part of the national KIPP network, teachers in each classroom rotate students among computer-based adaptive-learning programs, teacher-led small groups, and individualized instruction with teachers. Overall class sizes are twenty-eight or twenty-nine students per teacher (compared with about twenty in typical KIPP LA schools), but with half the class engaged in computer instruction at any given time, teacher-led groups number between fourteen and fifteen students for core subjects (reading, math, writing, and science).

Time-saving, Productivity-enhancing Tools

One way to free teachers’ time is to off-load some instructional duties to digital instruction. Another is to find ways for digital tools to streamline noninstructional tasks that take teachers’ time but are important for excellent student outcomes. According to data from the 2007–08 *Schools and Staffing Survey*, elementary and secondary teachers spend twenty-two and twenty-four hours per week, respectively, on noninstructional duties (things like administrative paperwork, etc.).¹³ Could digital tools help reduce that load?¹⁴ Here is a list of instructional and noninstructional duties and a sampling of tools designed to streamline them:

- *Compiling and analyzing student data*. New York City, working with the technology firm Wireless Generation, implemented the Achievement Reporting and Innovation System (ARIS) to put a wide array of data and analysis at teachers’ fingertips.¹⁵
- *Personalizing instruction modes and levels of work*. School of One provides the math program at three New York City middle schools. School of One’s “learning algorithm” recommends to teachers a daily schedule (“playlist”) of learning activities tailored for each student, reducing teachers’ lesson-planning load.¹⁶

- *Finding or creating lesson plans and materials.* BetterLesson is a free website that invites teachers to “find lesson plans, classroom materials and instructional resources from high-performing teachers.”¹⁷ Taking a different tack is Teacher-sPayTeachers, an open marketplace launched by a former NYC teacher, where teachers buy and sell original teaching materials. Subscription-based netTrekker enables teachers (and students) to search 300,000 “digital resources” that it says have been “vetted by high-performing teachers.”¹⁸ Since the quality of materials posted to such sites is likely to vary widely, one key to their success will be enabling the best to rise to the top based on user ratings or, better yet, efficacy with students.
- *Performing administrative tasks.* Numerous electronic “gradebooks” have emerged to track attendance, keep calendars, and share assignments and grades with students and parents. Examples include Engrade and LearnBoost.¹⁹

Beyond time-technology swaps, digital tools can also free great teachers’ time in other ways. (See the sidebar “Time-saving, Productivity-enhancing Tools.”)

Remote Instruction

Remote instruction comes in two flavors: “synchronous” and “asynchronous.” In synchronous instruction, the teacher and the students are interacting with one another in real time via videoconference, video-chat, shared online “whiteboards,” audio-conference, online text chat, or even just simple telephone calls. Cameras placed in classrooms can give remote teachers visual access to whole classes, enabling these educators to be aware of how students are responding to their instruction. As technology improves, this kind of interaction is likely to feel increasingly like natural, in-person interaction—especially as video conferencing becomes smoother and as three-dimensional holograms of teachers or “immersive” online environments, like those experienced in games, are used more frequently.²⁰

In asynchronous instruction, teachers still interact with students, but not in real time. Instead, they provide written online feedback on assignments, answer students’ questions via email, or post a response to an online discussion board for many students to see.

Remote instruction opens up numerous professional opportunities for teachers that are less likely or impossible in an all-in-person environment:

- *Living where you want to live.* One of the biggest challenges in providing great instruction to all students is that many children live in places with a limited

supply of good, or great, in-person teachers—with rural areas as the prime example. Remote instruction makes it possible for teachers to live where they want to live, while educating students where *they* live.

- *Choosing a work setting.* Remote teaching enables individual teachers to work from home, or pods of remote teachers to work in an office together as is common in other professions. Remote instruction also enables teachers to combine in-person teaching with remote duties. In Alabama’s online school, for example, most of the faculty members have traditional teaching jobs during the day.²¹
- *Individualizing instruction.* Remote learning can increase the amount of personal individualized attention a teacher provides students. Distance paradoxically can make it easier for educators, who do not have the additional duties that an in-person teacher typically would, to focus on one student at a time. Innosight Institute’s profile of Riverside Virtual School, for example, reports, “Overall, teachers say that they interact more with students as online teachers than when they are teaching a face-to-face course. Students also report having higher levels of engagement.”²²
- *Specializing.* As Rick Hess and others have argued, one promising way to improve the teaching profession is to “unbundle” the teaching role, enabling teachers to specialize in the aspects of teaching they do best—delivering engaging presentations, tutoring in small groups, or leading analytic discussion sections.²³ Focusing the time of great teachers on specific tasks linked directly to student achievement and relieving them of less significant duties can free their time to teach more students.
- *Leveraging time by managing or assisting other remote teachers.* An excellent remote teacher with managerial or coaching competencies could remain a teacher while also supervising or helping one, two, or more other teachers.²⁴ If teachers in this role are truly accountable managers rather than just unaccountable advisors, it will actually extend the reach of the excellent teacher’s standards and practices—and create meaningful career paths for educators who want to remain teachers.²⁵

Boundless Instruction

Remote instruction is limited by a scarce resource: the time of the teacher. Even if teaching remotely allows an instructor to reach more students, a person can work only so many hours in a day.

With boundless instruction, teachers capture their instructional prowess in a way that can then be shared widely, with a theoretically unlimited number of students. Two primary modes of boundless instruction are becoming increasingly common, each of which suggests new roles for great teachers:

- *“Mediagenic” superinstructors.* The ability to broadcast video lessons over the Internet makes it possible for teachers who are excellent content explainers to become star teachers, reaching a potentially boundless number of students. The most well-known of these efforts, undertaken by the Khan Academy, made 2,600 video lessons available online on a wide range of subjects; these have been viewed over 80 million times by people worldwide (as of October 2011).²⁶ Other examples include video course libraries made available by universities such as Carnegie Mellon and MIT and initiatives like Learning Match that enable individual teachers to test and then submit their own video lessons. We expect that video may expand to include holograms someday soon, given the rapid progression of holographic technology. The potential benefits to students are obvious: As this technology advances, no student should ever have to learn about the quadratic formula, or the causes of the Civil War, or the dynamics of supply and demand from anyone other than the very best explainers of those topics worldwide.
- *Application architects.* The digital explosion offers another set of opportunities for teachers: They can create or help design software applications that guide students through a series of “lessons,” making it possible for them to master academic content without direct teacher interaction. In *Disrupting Class*, Clayton Christensen, Michael Horn, and Curtis Johnson write about Virtual Chem Lab, an online application that enables students to engage in simulated chemistry experiments. Virtual Chem Lab is used by 150,000 students and is one of many examples of applications created by instructors eager to extend themselves to a larger number of students.²⁷ In New York City’s Quest to Learn School, teachers collaborate with video game designers from the Institute of Play to create game-based learning experiences that can be used both within Quest to Learn and also boundlessly.²⁸

Attracting and Retaining the Best

Digital learning has the potential to create new career opportunities for excellent teachers. As they reach more students, they should be able to earn more—out of the per-pupil funding attached to a larger number of students. The chance of enhanced advancement and pay will, in turn, make the profession a more attractive long-term career for high performers. As a result, U.S. public education should have an easier time attracting and retaining top talent in teaching, ultimately making the profession a more welcoming place for high-achieving graduates to spend full careers. The United States won't need as many teachers; as in other industries, technology will do increasing portions of the work and enable other, lower-paid staff members to support both students and the excellent teachers in charge of their instruction.

Boosting Average Teachers' Effectiveness

In addition to giving dramatically more students access to excellent teachers, digital learning also has the potential to boost the effectiveness of average teachers—those who keep their students on track, but who struggle to close achievement gaps or help middling students leap ahead. We see several ways that digital learning could help these teachers achieve better outcomes. We keep this analysis brief, as this topic has been well examined by other commentators:²⁹

- *Delivering initial knowledge and skill instruction.* The more students are learning through the “smart software” described above, the more time teachers will have to help students overcome learning barriers and to teach higher-order skills. Meanwhile, schools can ensure the accuracy and consistency of basic knowledge and skill instruction delivered digitally.
- *Generating real-time student data and lesson-plan advice.* Today's best teachers excel at diagnosing each student's needs and planning instruction accordingly. Digital technology holds the promise of providing other teachers with similar insight, by analyzing results and recommending next steps personalized to the student's needs.
- *Enhancing professional development.* Digital technology makes it possible for teachers to learn from videos of great teachers, obtain critical and timely feedback on their own video-recorded lessons, and connect with other teachers as mentors or peer-helpers. Some portion of excellent teachers' time freed in time-technology swaps also can be used to coach or manage peers.

Not There Yet

To realize the changes in the teaching profession discussed here, the digital landscape itself will need to improve in at least three ways. First, as the Digital Learning Now! signatories and others have said, providing universal low-cost access to broadband Internet for all K–12 teachers and students—during and beyond “school hours”—would greatly accelerate the nation’s ability to start implementing these ideas.³⁰

Second, digital users do not yet have platforms that help them find and deploy the best and best-fit among the explosion of digital resources. The lack of platforms that connect digital resources to varying curricula and individual child needs is a major barrier to personalizing learning. In all likelihood, the marketplace will increasingly provide multiple versions of such an integrative platform, but for now it remains an item on the “technology wish list” of the schools featured in *The Rise of K–12 Blended Learning*.³¹

Finally, digital instruction must become significantly better than some aspects of in-person instruction, ultimately matching excellent teachers. Measurement of digital learning effects on student outcomes is nascent, but research indicates only a small edge over average instruction for now.³² Without significant improvements, the major educational benefit of digital learning will be allowing successful time-technology swaps to extend the reach of excellent live instructors. Instead, the two in tandem—excellent digital tools and excellent live teachers for all children—should be the goal of policy changes.

- *Enabling specialization.* As more of the work of teaching is handled by means of digital technology, teachers can increasingly specialize in their teaching strengths—such as particular subjects or parts of the teaching process. Some teachers who are average overall may be excellent specialists.
- *Introducing time-saving, productivity-enhancing tools.* Such tools can free teachers’ time for understanding student data, planning lessons, or personalizing instruction. (See the sidebar “Time-saving, Productivity-enhancing Tools.”)

Resculpting Policy and Management Systems

The changes described above won’t happen automatically. Digital learning will have to improve significantly (see the sidebar “Not There Yet”). In addition, policies and management systems must change in order to make these new arrangements viable.³³ Here, we briefly explore policies that are particularly relevant to the

teacher role: those related to training and professional development, certification, class size, evaluation and supervision, compensation and related finance systems, employment arrangements, and unionization.

Training and Professional Development

Teacher training and professional development (PD) will need to change in two primary ways as digital learning becomes more prevalent.³⁴ First, digital learning will change *what teachers need to learn*. As teaching becomes more differentiated, so must teacher training and PD. Putting on a top-notch video-recorded teaching performance requires a competency and skill set different from those needed for, say, remote tutoring—and certainly different from those needed by an effective in-person educator.

Teacher-preparation programs and ongoing PD must address these new needs. But one factor will help lighten the training load: The passage of time will also involve a generational shift, with the ranks of teachers increasingly filled by “digital natives,” who grew up using digital tools, rather than “digital immigrants,” who did not.³⁵ Indeed, we can already see many signs of increasing technological proficiency among teachers. In 2000, the average state reported that in 28 percent of schools, more than half were “beginners” when it came to technology. By 2005, the percentage was down to 15, and one can only think it has continued to decline.³⁶

Second, digital learning can change *how teachers receive training and PD*. In 2005, the average state reported that 34 and 35 percent of its schools delivered PD online or via video, respectively. By 2006, these percentages were up to 65 and 74. More recent data are unavailable, but it seems likely that these percentages have continued to increase. In the digital age, teachers’ roles are likely to shift over time, as technology makes different modes of teaching possible, and as individuals advance their instructional careers. PD, too, needs to be dynamic, available “on demand” rather than in big dollops at the beginning of a teacher’s career and during summers.³⁷

Certification

Today’s certification practices do little to screen out ineffective teachers, and they appear to prevent some high-potential candidates from entering the profession.³⁸ The digital age makes certification reform even more pressing for two reasons:

- *The need to teach across state lines.* The use of digital tools can extend teachers' reach nationally and internationally. This possibility heightens the importance of eliminating state-based certification barriers: No policy should block great teachers from reaching a given state's children, no matter where teachers reside or which license they hold. State policies need to be swiftly amended to fix this issue. If they are not, federal policymakers should step in: Under the interstate commerce clause, the emerging interstate economy for instruction allows for federal preemption of state laws that affect this national talent exchange. Just as federal law prevents individual states from restricting commerce across state lines in other industries, federal action could trump state policies that keep great teachers who reside elsewhere from instructing the state's children virtually.
- *The need to use noncertified personnel.* Under some state-certification laws, a licensed teacher must supervise students who are taking core courses, even if they are learning online. This restriction undermines the economics of using digital learning to free great teachers' time, pay them more, and save money. Without such restrictions, schools could employ less expensive nonlicensed personnel to monitor students, splitting cost savings between salaries for the fewer, better in-person teachers and the school. Unless paired with shared cost savings, digital instruction will not launch the kind of virtuous cycle of sustainable excellence described above, in which digital instruction enables excellent in-person teachers to reach more students, enables schools to pay them more for doing so, and thereby entices greater numbers of excellent teachers to enter and stay in the profession.

Class Size

Thirty-six states currently have some limit on class size.³⁹ These limits apply equally to the best and worst teachers. Digital learning bumps up against class-size restrictions in two ways. First, limiting the number of students that a remote instructor can serve would detract from one of the key potential advantages of this type of instruction: the ability of excellent teachers to reach more students. Second, even in brick-and-mortar schools, class-size restrictions can limit the advantages of digital learning. Schools are configuring students in myriad ways, having them, at different times, work independently, in small groups, in learning labs, and in traditional classroom-based settings. Without this flexibility, it would be difficult for these schools to blend digital and in-person learning. State

policyholders should eliminate simplistic across-the-board limits or, at the very least, build in the possibility of flexibility for schools that have an alternative model.

Evaluation and Supervision

The rise of digital learning presents both bad news and good news for teacher-evaluation reform. The bad news is that today's new evaluation systems are largely being built for a traditional one-teacher-one-classroom model, at exactly the time that this conventional mode seems poised to decline. The role changes described above create two challenges for teacher evaluation.

First, digital tools will make it increasingly possible to “unbundle” the teacher's role, so that multiple people (rather than a single teacher) contribute to a student's learning. Of course this is not completely new, but it is likely to accelerate in the digital age, as little Susie receives algebra instruction via video, has her homework assigned and graded by a remote teacher, and receives extra help from a classroom paraprofessional. In this multiperson context, how can each participant's “value-add” be identified?

This complexity means that, whatever arrangements emerge, policies should require that one adult be ultimately accountable for each student's learning in each measured subject. That adult could be in-person or remote. That adult may employ digital tools, enlist other adults, and otherwise mobilize resources on behalf of the child. But for the state's or district's teacher-evaluation system, the student “counts” for that teacher's evaluation. Accordingly, this accountable adult must have significant choice over resources—human and otherwise—used in the child's education as well as adequate data about performance of those resources, a topic to which we return in our conclusion.

Second, as teacher roles become more differentiated, a simplistic rating of each teacher as “highly effective,” “effective,” and so forth becomes less meaningful. Teachers themselves, their peers and supervisors, and students' parents will need to know not just how effective teachers are overall (already a tricky task), but how effective they are in specific roles within the teaching process. Teachers who are highly effective at leading a whole in-person classroom, for example, may be less effective at remote education and vice versa. Likewise, teachers who are experts at teaching about the Civil War may stumble when asked to explain the Progressive Era. Ideally, data and evaluation systems will become multidimensional, yielding insight not just about how effective teachers are, but

in what aspects of teaching they are effective.⁴⁰ Increasingly, evaluation systems will need to examine not just outcomes and easily observable practices, but the underlying competencies that determine individuals' fitness for different roles.⁴¹ Developing these systems will take time, but will ultimately be more useful than less nuanced approaches.

The good news for teacher evaluation is that the digital age should make possible unprecedented levels of transparency in teaching (and data collection) that should, in turn, facilitate evaluation and developmental feedback for teachers. In today's "closed-door" classrooms, little of what goes on can truly be captured in a way that would enable a teacher's peers, supervisors, or coaches to see how he or she is teaching. Observations can help, but they are inevitably sporadic and somewhat artificial. The more teaching that happens virtually, the more observable it becomes—both live, and in retrospect.

Compensation and Related Finance Systems

Though new compensation structures will be needed, we do not here prescribe an alternative compensation system for the digital age. Organizations will want to engage different approaches that fit their circumstances. What works for a statewide public virtual school might not be best for a for-profit online-education provider, a cyber charter network, or a district that is blending digital and in-person learning.

Instead, we offer three observations:

- *The need for flexibility.* State policies or collective-bargaining agreements that mandate lockstep salary schedules and tie funding to specific positions must be set aside to enable teacher pay to reflect the sort of role differentiation described above. Of particular importance are three kinds of flexibility: (a) the ability to pay excellent teachers more for educating a larger number of students successfully; (b) the flexibility to employ people not on the teacher salary schedule to perform roles such as monitoring digital-learning labs, tutoring, or performing parts of remote instruction, rather than requiring the use of licensed teachers for such duties; and (c) the ability to make school funding flexible more generally, enabling schools to allocate funds to different kinds of staff and technology to meet students' needs. Item (a) is in part a matter of simple fairness to excellent teachers, but also a key to starting the potential virtuous cycle of expanded great teacher reach, leading to greater pay and career opportunities, leading to higher levels of retention and

attraction of new high-caliber entrants. Items (b) and (c) are vital to unlocking the funds needed to make (a) possible.

- *Evolving finance systems and teacher compensation.* Chapter four of this volume—“School Finance in the Digital Learning Era”—addresses how school-finance systems need to change in the digital age. If, following the suggestion of some proponents, finance for digital learning moves toward a system in which providers are paid (either in full or in part) only if their students succeed, then providers will need to design teacher-compensation systems to align incentives. Outcome-based funding can encourage effective use of both digital learning and the adults accountable for its success.
- *The market for teacher talent.* The rise of remote and boundless instruction opens up the possibility of a national, or international, market for teaching talent. Especially if finance systems shift to rewarding providers for results, excellent teachers—in-person and online—will become increasingly valuable financially, and they should be able to leverage that value into higher compensation for themselves. Whether they are providing remote instruction to specific groups of students, converting their teaching talent into boundlessly available resources like video recordings or smart software, or using digital instruction to extend their reach in-person, top teachers should have expanded earning opportunity. How all this will sort out in the marketplace is, of course, uncertain. The most well-known provider of video instruction, the Khan Academy, currently provides all its content free of charge and covers costs with philanthropy. In Korea, where teaching excellence is revered, superinstructors can earn six or seven figures.⁴² Enabling great U.S. teachers to earn what they are worth to society may be necessary in order to scale up a sustainable national marketplace for great teachers.

Employment

The more divorced teaching becomes from a specific school site, the easier it becomes to imagine different kinds of employment arrangements for teachers. Some of these are implied in previous sections, but there are other possibilities as well:

- *Working for a virtual school or online education provider.* Already, an increasing number of teachers work for one of the state-run or charter virtual schools or private providers of online education, full time or in addition to their “day jobs” as in-person teachers. As these providers grow, they will create other

opportunities for teachers to contribute, such as by recording top-notch videos of content that can become part of providers' libraries.

- *Working as a provider of specialized instruction.* Online providers like Connections Academy and K12 offer the full range of content. But other providers are emerging to offer more specialized services, such as Presence Telecare, which uses videoconferencing to offer online speech therapy. Presence employs licensed speech therapists nationally who work from home on a flexible schedule. Similar services are likely to emerge across other specialties, including core academic-content areas. These services could hire teachers as employees or consultants, or could be organized, owned, and run by teachers themselves, just as in law, medicine, and other professions.⁴³
- *Working as a designer.* Teachers will have increasing opportunities to contribute to “boundless” instructional resources such as smart software, either by developing it themselves or by working as an employee or contractor for developers.

Unions

Terry Moe and John Chubb (author of chapter five, “Overcoming the Governance Challenge in K–12 Online Learning”) predict that unions will inevitably lose out as digital learning takes hold, because of lost geographic concentration and reduced number of teachers, both of which are key to union power.⁴⁴ While this is a plausible outcome, we see another possibility.

Whatever the effect of digital learning on the overall number of jobs in the education sector, there can be little doubt that technology will transform the field into a much wider array of differentiated roles in comparison to today's one-teacher-one-classroom model. Union leaders who grasp this reality and step in to support employees in this changing sector may keep their organizations viable. Those who do not adapt may face trouble as the employment structure shifts. Union relationships could enable predictable wages for a growing number of roles and portable benefits that employees may carry with them into new jobs. Education unions that provide benefits directly may attract free-agent employees who want security in a work environment where roles and jobs are changing and where not all labor is attached to specific schools in full-time, permanent positions. Motion picture and other entertainment-industry unions may provide starting-point models for the future of education: Stars are paid for their disproportionate

economic and entertainment value, but other professionals are paid predictable wages and have access to benefits. In these sectors, union rules set minimum pay for supporting roles without limiting pay for top-tier performers.

A Revitalized Teaching Profession, If We Have the Will

These potential changes bode well for the teaching profession, which has the chance to become, like other professions, an “opportunity culture” that gives teachers a wide array of ways to advance while still remaining teachers, and to be rewarded for their contributions.⁴⁵ They bode especially well for consistently excellent teachers, who stand to gain the most in terms of expanded opportunities and rewards, and whose ranks should increase because of the enhanced attractiveness of the job to high performers. But they also bode well for average teachers who, by taking advantage of the time-saving potential of digital tools and other potential benefits, will have much greater opportunity to contribute to excellence than they can in traditional classrooms.

This is not to say the changes bode well for *all* teachers. As the nation comes to need fewer instructors per pupil, school providers will be able to push out the very least effective teachers (if policy allows). These changes would be positive for students and the public, as schools should be able to achieve better results, within current budgets, by employing fewer, better teachers.

While digital learning will mean fewer traditional teachers, not all of these jobs will disappear: Some will be replaced by new roles, such as monitoring students during digital instruction time, providing small-group tutoring, and performing noninstructional duties. Remote and boundless instruction will open all kinds of jobs for people in technical fields, but also for people who can play specialized nonteaching roles online to help students as they work with the technology. Where today’s teaching profession resembles the bygone age of the solo general-practitioner doctor carrying out all of the practice’s tasks himself, tomorrow’s is likely to look increasingly like the modern medical field: with a wide array of different professionals and paraprofessionals playing a range of roles that together add up to a coherent system of service delivery centered around patients. Similar changes occurred in the legal profession, enabling better lawyers to earn more by serving more clients with teams of junior associates, paralegals, and administrative assistants. All of this is so familiar today that it is easy to forget how recently these significant changes occurred.

Of course, this is easy to envision on paper. Without a strong demand from education providers to use digital learning effectively, uptake will be slower than it could be. Likewise, the significant changes in policy and management systems that are needed to usher in these new opportunities will not happen, or will happen much too slowly to keep up with the potential of technology.⁴⁶

One way to create this demand would be to empower excellent teachers who have already proven they are driven to succeed. What if schools, districts, or even states gave willing individual excellent teachers the power and funding to integrate digital technology (and other human resources) into learning, in exchange for taking on a larger load of students? What if these great teachers gained control of a good portion of the funding generated by their expanded numbers of students? This power to purchase, use, and change digital and human resources, and to assess the options based on data and prior results, would allow the person accountable for students' results to determine curricular content and better ensure student achievement. What if not just one or a few excellent teachers gained that power, but thousands or tens of thousands?

Whether through that approach or some other, the nation's schools and policymakers will need the courage to dramatically change—and not just nibble away at the edges of—a profession that has remained static as other professions have advanced. Without that courage, our teachers and students—and our nation—will miss an enormous opportunity made possible by the advent of digital technology while other nations undoubtedly seize it.

Endnotes

1. Cited in Tim Walker, "Laptops Are Not Teachers," *NEA Today*, April 1, 2011, <http://neatoday.org/2011/04/01/laptops-are-not-teachers/>.
2. Gregory Ferenstein, "Teacher-Replacing Tech: Friend or Foe?" *Fast Company*, February 1, 2011, <http://www.fastcompany.com/1722914/can-computers-replace-teachers>.
3. Emily Ayscue Hassel and Bryan C. Hassel, *3X for All: Extending the Reach of Education's Best* (Chapel Hill, NC: Public Impact, 2009), http://www.publicimpact.com/images/stories/3x_for_all-public_impact.pdf.
4. See Hassel and Hassel, *3X for All*; Clayton M. Christensen, Michael B. Horn, and Curtis W. Johnson, *Disrupting Class: How Disruptive Innovation Will Change the Way the World Learns* (New York: McGraw-Hill, 2008); Terry M. Moe and John E. Chubb, *Liberating Learning: Technology, Politics, and the Future of American Education* (San Francisco: Jossey-Bass, 2009).

5. See Michael Horn, “Why Digital Learning Will Liberate Teachers,” *Innosight Institute*, August 9, 2011, <http://www.innosightinstitute.org/education-blog/why-digital-learning-will-liberate-teachers/>; Alex Hernandez, “Blended Learning’s Impact on Teacher Development,” *Innosight Institute*, July 11, 2011, <http://www.innosightinstitute.org/education-blog/blended-learning-impact-on-teacher-development/>; Tom Vander Ark, “10 Reasons Teachers Love Blended Learning,” *Huffington Post*, July 11, 2011, http://www.huffingtonpost.com/tom-vander-ark/10-reasons-teachers-love-_b_894222.html. On rethinking teacher roles more generally to enable average teachers to contribute to excellence, see various writings of Frederick M. Hess and his colleagues, including “How to Get the Teachers We Want,” *Education Next* 9, no. 3 (2009), <http://educationnext.org/how-to-get-the-teachers-we-want/>; Jane Coggshall, Molly Lasagna, and Sabrina Laine, *Toward the Structural Transformation of Schools: Innovations in Staffing* (Naperville, IL: Learning Point Associates, 2009), <http://www.learningpt.org/expertise/educatorquality/resources/publications/InnovationsInStaffing.pdf>; and Barnett Berry and the Teacher Solutions 2030 Team, *Teaching 2030: What We Must Do for Our Students and Our Public Schools* (New York: Teachers College Press, 2011).
6. For the data and calculations behind this conclusion, see Bryan C. Hassel and Emily Ayscue Hassel, *Opportunity at the Top: How America’s Best Teachers Could Close the Gaps, Raise the Bar, and Keep Our Nation Great* (Chapel Hill, NC: Public Impact, 2010), notes 12 and 15, http://opportunityculture.org/images/stories/opportunity_report_web.pdf.
7. Hassel and Hassel, *3X for All*.
8. Emily Ayscue Hassel and Bryan C. Hassel, *Seizing Opportunity at the Top: How the U.S. Can Reach Every Student with an Excellent Teacher* (policy brief) (Chapel Hill, N.C.: Public Impact, 2011), http://opportunityculture.org/seizing_opportunity_policybrief-public_impact.pdf; and “Seizing Opportunity at the Top: How the U.S. Can Reach Every Student with an Excellent Teacher” (working paper), Public Impact, Chapel Hill, NC, 2011, http://opportunityculture.org/seizing_opportunity_fullreport-public_impact.pdf.
9. Digital learning may itself contribute to improved teacher evaluations by producing a stream of real-time information about individual students’ learning, an improvement over today’s end-of-year test-based systems.
10. For more on “time-technology swaps,” see Public Impact, “Reaching More Students with Great Teaching: Summary Reach Extension Models,” www.opportunityculture.org. See also Christensen, Horn, and Johnson’s discussion of “disruptively deploying computers” in *Disrupting Class*; and Paul T. Hill, *Learning as We Go: Why School Choice Is Worth the Wait* (Stanford, CA: Hoover Institution Press, 2010), pp. 68–71.
11. In theory, students could spend time on digital learning at home. Though some schools are experimenting with such “homework flipping,” it faces limits, as we have written elsewhere (e.g., “Khan Academy: Not Overhyped, Just Missing a Key Ingredient—Excellent Live Teachers,” *Education Next* blog, June 13, 2011, <http://educationnext.org/khan-academy-not-overhyped-just-missing-a-key-ingredient-%E2%80%9393-excellent-live-teachers/>). The 2004 National Assessment of Educational Progress survey of students found that 39 percent of high schoolers *do no homework*, and another 28 percent do an hour or less each night. M. Perie, R. Moran, A. D. Lutkus, *NAEP 2004 Trends in Academic Progress: Three Decades of Student Performance and Reading and Mathematics* (Washington, D.C.: U.S. Department of Education, Institute of Education Sciences,

and National Center for Education Statistics, 2005), p. 51. Thus most students do not have much homework time to flip. In addition, home access to broadband Internet remains spotty, especially for low-income students.

12. Heather Staker, *The Rise of K–12 Blended Learning: Profiles of Emerging Models* (Mountain View, CA: Innosight Institute, 2011).

13. National Center for Education Statistics, *2007–08 Schools and Staffing Survey*, table 6, http://nces.ed.gov/pubs2009/2009324/tables/sass0708_2009324_t12n_06.asp#f2.

14. Even without digital tools, schools could reduce the noninstructional time of great teachers and free them up to reach more students by reassigning noninstructional tasks to other staff. For a discussion of noninstructional time swaps, see Public Impact, “Reaching More Students with Great Teaching.”

15. For more on ARIS, see Arthur VanderVeen, “Smarter Data Systems: The New York City Experience,” *Quick & the Ed*, March 15, 2010, <http://www.quickanded.com/2010/03/smarter-data-systems-the-new-york-city-experience.html>.

16. See School of One’s homepage at <http://schoolofone.org>.

17. See BetterLesson’s homepage at <http://betterlesson.org> and KIPP:Share’s homepage at <https://share.kipp.org>.

18. See netTrekker’s homepage at <http://www.nettrekker.com>.

19. See engrade’s homepage at <http://www.engage.com> and LearnBoost’s homepage at <https://www.learnboost.com>.

20. Holographic technology has improved significantly in the past decade, so that viewers in a room can see the images from any angle. Volumetric displays are used to present the image. Whole classrooms might become volumetric displays, or computers might be able to present small, personalized holographic images to students. See, for example, P. A. Blanche et al., “Holographic Three-Dimensional Telepresence Using Large-Area Photorefractive Polymer,” *Nature* 468, no. 7320 (2010), <http://www.nature.com/nature/journal/v468/n7320/full/nature09521.html>.

21. Staker, *Rise of K–12 Blended Learning*, p. 13.

22. Staker, *Rise of K–12 Blended Learning*, p. 128.

23. See note 5 above for citations. See also chapter two in this volume, “Quality Control in K-12 Digital Learning” by Frederick Hess.

24. Somewhat paradoxically, remote instruction may make it easier for supervisors and peers to monitor and assist teachers with their instruction by making teaching more transparent. There is not much of a “classroom door” to “close” in the online world.

25. This role could exist for in-person teachers, too. Some schools have “lead teachers,” “mentors,” and “coaches,” but these positions rarely involve the accountable management we intend. Instituting this model within remote instruction may be easier, because organizational routines are less established (for now) in online education. Newly hired remote educators would sign up understanding they’d be working in teacher-led pods. For more discussion of extending the reach of great in-person teachers in this way, see Public Impact, “Reaching More Students with Great

Teaching.”

26. See Khan Academy’s homepage at <http://www.khanacademy.org>. Data on number of videos and views are as of October 14, 2011.

27. Christensen, Horn, and Johnson, *Disrupting Class*.

28. Staker, *Rise of K–12 Blended Learning*, p. 125. Note that software designers need not have been teachers previously, but the best of them, like excellent teachers, will have a strong grasp of what motivates children, as well as deep content knowledge.

29. See note 5 above for references.

30. Digital Learning Now!, *10 Elements of High Quality Digital Learning* (Tallahassee, FL: Foundation for Excellence in Education, 2010), p. 13, <http://www.excelined.org/Docs/Digital%20Learning%20Now%20Report%20FINAL.pdf>.

31. Staker, *Rise of K–12 Blended Learning*, p. 172.

32. U.S. Department of Education, Office of Planning, Evaluation, and Policy Development, *Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies* (Washington, D.C.: U.S. Department of Education, 2010).

33. See Digital Learning Now!, *10 Elements of High Quality Digital Learning*.

34. For further discussion, see Hernandez, “Blended Learning’s Impact on Teacher Development.”

35. Marc Prensky, “Digital Natives, Digital Immigrants,” *On the Horizon* 9, no. 5 (2001), <http://www.marcprensky.com/writing/prensky%20-%20digital%20natives,%20digital%20immigrants%20-%20part1.pdf>.

36. The figures are authors’ tabulations from the table generated by *Education Week*, Education Counts online table builder, custom table run June 2011.

37. In many ways, this imperative is no different from what researchers said PD should be like even in the predigital age. Lucy Steiner, *Designing Effective Professional Development Experiences: What Do We Know?* (Naperville, IL: Learning Point Associates, 2004), http://www.tqsource.org/issueforums/plantoAction/resources/4_PDResearchPolicyAction/DesigningEffectivePD.pdf.

38. Dan D. Goldhaber and Dominic J. Brewer, “Does Teacher Certification Matter? High School Teacher Certification Status and Student Achievement,” *Education and Policy Analysis* 22, no. 2 (2000): 129–45; Thomas J. Kane, Jonah E. Rockoff, and Douglas O. Staiger, “What Does Certification Tell Us About Teacher Effectiveness? Evidence from New York City,” *Economics of Education Review* 27, no. 6 (2008): 615–31, <http://www.gse.harvard.edu/news/features/kane/nycfellows-march2006.pdf>; Dan Goldhaber, “The Mystery of Good Teaching,” *Education Next* 2, no. 1 (2002): 50–55, <http://educationnext.org/the-mystery-of-good-teaching/>.

39. Kyle Zinth, *Maximum P-12 Class-Size Policies State Note* (Denver: Education Commission of the States, 2009), p. 1, <http://www.ecs.org/clearinghouse/82/91/8291.pdf>.

40. One step in this direction is the Southern Regional Education Board’s *Standards for Quality Online Teaching* (Atlanta: Southern Regional Education Board, 2006), http://publications.sreb.org/2006/06T02_Standards_Online_Teaching.pdf. The International Association for K–12 Online

Learning (iNACOL) has endorsed this work as a standard for the industry.

41. For more on competencies as part of teacher evaluation, see Public Impact, *How Should States Define Teacher Effectiveness?* (Chapel Hill, NC: Public Impact, 2009), http://www.publicimpact.com/publications/PublicImpact-How_Should_States_Define_Teacher_Effectiveness.pdf.

For competencies in general as predictors of work performance, see Lyle M. Spencer and Signe Spencer, *Competence at Work, Models for Superior Performance* (New York: John Wiley and Sons, 2003). For Singapore's use of competencies in its teacher evaluation system, see Lucy Steiner, *Using Competency-based Evaluation to Drive Teacher Excellence: Lessons from Singapore* (Chapel Hill, NC: Public Impact, 2010), http://www.publicimpact.com/images/singapore_lessons-public-impact.pdf.

42. "Where a Teacher Can Make Millions," *Bloomberg Businessweek*, December 11, 2006, http://www.businessweek.com/magazine/content/06_50/b4013056.htm.

43. Education | Evolving, *Teachers in Professional Practice: An Inventory of New Opportunities for Teachers*, 2nd ed. (St. Paul, MN: Education | Evolving, 2006), http://www.educationevolving.org/pdf/Teachers_In_Pro_Practice_2ndED.pdf.

44. Moe and Chubb, *Liberating Learning*, p. 158.

45. Hassel and Hassel, *Opportunity at the Top*, p. 22.

46. Public Impact's working paper "Seizing Opportunity at the Top" outlines major federal and state policy options for "inducing demand," but these are beyond the scope of this paper.