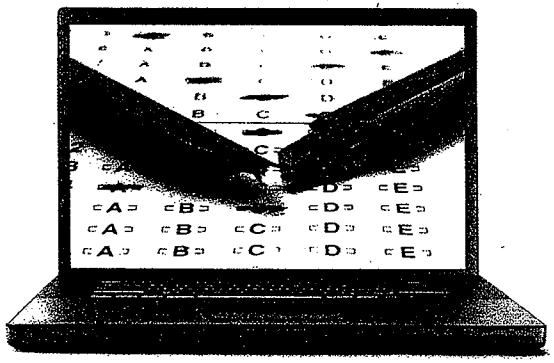
"A brilliant teacher, Christensen brings clarity to a muddled and chaotic world of education." –JIM COLLINS, bestselling author of *Good to Great*

Disrupting Class

How Disruptive Innovation Will Change the Way the World Learns



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Chapter 2

Making the Shift: Schools Meet Society's Needs

Fresh from a meeting with his new boss, Carlos Alvera turns his sputtering car out of the school parking lot exit and looks to his left, where cars stream by him. The directions to the state teachers' convention weren't too clear, but this year, for once, he's determined to go. Stephanie Allston makes him nervous. State standards make him nervous. He goes right and makes another turn to go toward the interstate and the university, the home of this year's meeting. At least when he asked, Allston agreed to make Alvera one of the Randall delegates.

In previous years, he'd turned down many chances to go to the state teachers' convention. But this year, many things have changed. Any day now, the powers that be may declare his school a failure. And Allston's presence signals change: the newcomer seems hell-bent on doing things differently, even if Alvera isn't sure what good it would do.

Randall High has been around for longer than Alvera's 25 years of service. But as an urban high school, it is now in the bulls-eye of the California Standardized Testing and Reporting (STAR) program. And it's not looking good, despite the fact that Randall High has adequate facilities, a qualified faculty, a varied curriculum, and strong arts and athletics programs. How did Randall High, Alvera's second home, end up looking so bad?

At the convention at Middleburg University, Alvera passes the time by making small talk with the other teachers. The teachers gab about tests, principals, unions, and standards. It is with a rising sense of alarm that he notes the frequent use of the word "achievement." It's not that he's opposed to success, but when, Alvera muses, did society start expecting schools to ensure achievement and not merely access to education?

He pulls back into the Randall parking lot at the end of the day, ready to coach the Chemistry Bowl team as usual. It's the same thing he's done every Wednesday for years—but as he walks into the building, he realizes that while his job might be the same, his job description sure seems different. He hefts the conference tote bag onto his shoulder and notes its heaviness. He hasn't had a chance to go through all the material yet, but he hopes like crazy that there's something useful in the 10 pounds of paper they handed out.

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Alvera is right. Randall Circle High School used to be viewed as a great school as it built up a vast array of programs to serve its large, diverse student population over many years. In our research on innovation, improving the products and services that organizations are providing at a pace that satisfies customers actually is rarely a problem. Most companies want to keep improving what they do—and generally they are quite good at doing just that. The public school system is no different. As we will show, contrary to widespread perception, on average, public schools have a steady record of improving on the metrics by which they are judged, just like the other organizations we've studied.

What our studies of innovation show, however, is that a specific type of innovation, which we call *disruption*, almost *always* trips up well-managed, improving companies. Disruption is difficult because the definitions and trajectories of improvement change. What were valuable improvements before the disruption now are less relevant. And dimensions of the product that had been unimportant become highly valued.

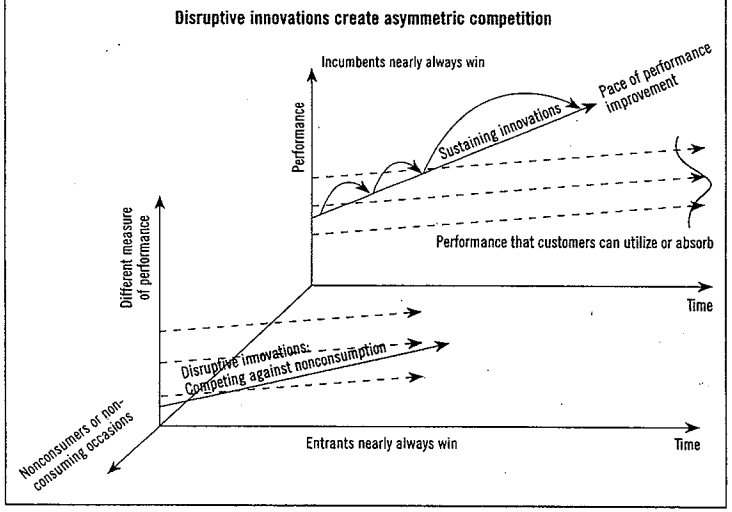
For a host of reasons we describe next, dealing with disruptive redirections in the trajectory of improvement has defied the abilities of even the most capable executives in the world's best companies.

In the past 25 years, as Alvera had begun to realize, two significant disruptions of this sort have swept through the U.S. public schools, marked by the Nation at Risk report and the No Child Left Behind Act. Assigning schools new jobs for which they were not built—and therefore are not necessarily doing—has meant that schools don't look as good in light of the new requirements. But given how difficult it is to negotiate these disruptive currents, as we show in the pages that follow, the schools have done remarkably well—which provides some hope that they may be able to switch to a student-centric learning mode, too, through a disruptive implementation of computer-based learning.

❖ THE DISRUPTIVE INNOVATION THEORY

The *disruptive innovation theory* explains why organizations struggle with certain kinds of innovation and how organizations can predictably succeed in innovation. Its basic constructs are depicted in Figure 2.1, which charts the performance of a service or product over time. Look first at the graph in the back plane of the three-dimensional diagram. It suggests that there are two types of improvement trajectories in every market. The solid line describes the pace of improvement companies deliver to their customers by introducing new and improved products and services. The dotted lines represent the rate of performance improvement that customers can utilize. As these intersecting lines suggest, customers' needs in a given market application tend to be relatively stable over time. But companies typically improve their products at a much faster pace than customers need so that products, which at one point were not good enough, ultimately pack in more features and functions than customers can use. By illustration, every year

FIGURE 2.1 Model of disruptive innovation



car companies give us new and improved engines, but most of us can't use all of the engine power they give us, because speed limits and traffic jams get in the way.

We call innovations that drive companies up the solid line *sustaining innovations*. As suggested at the back of Figure 2.1, some are dramatic breakthroughs whereas others are routine; but the competitive purpose of these innovations is to sustain the performance improvement trajectory in the established market. Airplanes that fly farther, computers that process faster, cellular phone batteries that last longer, and televisions with clearer images are all sustaining innovations. In our research, we have found that in almost every case, the companies that win the battles of sustaining innovation are already the industry leaders. And it seems not to matter how technologically challenging the innovation is. As long as it helps the leaders make better products that they can sell for better profits to their best customers, they figure out a way to get it done.

The technologies in the original "plane of competition" at the back of Figure 2.1 are typically complicated and expensive. As a result, the only people who can own and use the products are those who have a lot of money and a lot of skill. In the computer industry, for example, mainframe computers arose in the back plane. Companies such as IBM manufactured these gargantuan machines from the 1950s to the 1970s, and its customers paid millions of dollars to buy them. When people needed to compute, they took a big stack of punched cards to the corporate mainframe center and gave it to the computer expert, who ran the job for them. The mainframe companies focused their innovative energies on making bigger and better mainframes. They were good and successful at what they did. The same was true in automobiles, telecommunications, printing, commercial and investment banking, beef processing, photography, steel making, and many, many other industries.

All that would seem to make for a boring and orderly world. But from time to time, things get shaken up when a different type of innovation emerges in an industry—a *disruptive innovation*. A disruptive innovation is *not* a breakthrough improvement. Instead of sustaining the traditional improvement trajectory in the established plane of competition, it *disrupts* that trajectory by bringing to the market a product or service that actually is not as good as what companies historically had been selling. Because it is not as good, the existing customers in the back plane in Figure 2.1 cannot use it. But by making the product affordable and simple to use, the disruptive innovation benefits people who had been unable to consume the back-plane product—people we call "nonconsumers." Disruptive innovations take root in simple, undemanding applications in what, as depicted in the front of Figure 2.1, is a new plane of competition—where the very definition of what constitutes quality, and therefore what improvement means, is *different* from what quality and improvement meant in the back plane. The impact of this change in the definition of quality is that the disruptive products in the new plane are not attractive to the customers of

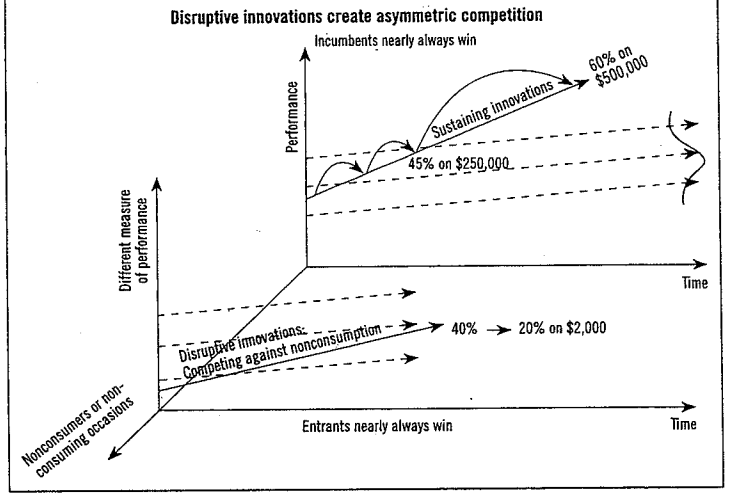
products in the original plane. They don't want and can't use them. Because companies need to meet the needs of their customers, the companies that made the products in the original plane of competition have a difficult time engaging simultaneously in the new, disruptive plane as well.

The personal computer is a classic example of a disruptive innovation. Prior to its introduction, the least expensive computer was the minicomputer, the name of which came from the fact that it was much smaller than mainframe computers, which had filled an entire room. But minicomputers cost well over $200,000, and required an engineering degree to operate them. The leading minicomputer company was Digital Equipment Corporation (DEC), which, during the 1970s and 1980s, was one of the most admired companies in the world economy. But it missed and was ultimately destroyed by the personal computer. Why?

Apple, one of the pioneers in personal computing, originally sold its model IIe computer as a toy to children. Children had been nonconsumers of computers before so they did not care that the product was not as good as the existing mainframe and minicomputers. None of DEC's customers could even use a personal computer for the first 10 years it was on the market because it wasn't good enough for the problems they needed to solve. That meant that the more carefully DEC listened to its best customers, the less signal they got that the personal computer mattered—because in fact it didn't—to those customers.

We've replicated in Figure 2.2 the chart from Figure 2.1, and we have added to it what the numbers for new products looked like to DEC's management. Note that in the original, back plane of competition, DEC could generate $112,500 (45% × $250,000) in gross margin dollars each time it sold a minicomputer. The $800 in gross margin dollars that could be earned from selling a personal computer paled in comparison to this profit engine in the mainstream of DEC—or to the $300,000 in margin dollars per machine (60% × $500,000) that they stood to make if they made even bigger and better mainframe computers.

FIGURE 2.2 The relative economics of sustaining versus disruptive innovations



Disruption rarely arrives as an abrupt shift in reality; for a decade, the personal computer did not affect DEC's growth or profits. During the early years after a disruptive innovation has taken root in simple applications in the new plane, users still must take their complicated problems to the expensive experts in the back plane.

But little by little the disruption improves. Just as the original players in a market innovate with predictability no matter how challenging the innovation, the same is true in this new market. The new companies introduce what for them are sustaining innovations along this new trajectory;[1] as long as an innovation helps a company make better products that it can sell for better profits, the company figures out a way to get it done. And at some point, users can take tasks that formerly could be done only in the back plane and do them in the affordable, accessible front plane. Apple and the other personal computer companies were no different.

Within a few years, powered by improvements in microprocessor technology, the smaller personal computers were capable of doing work that previously required mainframes or minicomputers. This made computing widespread and cheaper, and it created a huge new market. It left almost everyone—except the mainframe and minicomputer companies—better off. Disruption almost always kills such companies as they lose their customers. Again, DEC and the other minicomputer companies were no different; virtually all of them collapsed in the late 1980s.

The question people always ask is, "How in the world could these companies not see the train wreck coming?" They certainly do not lack resources like money or technological expertise. What they do lack, however, is the motivation to focus sufficient resources on the disruption. Why is this? In the years when the companies must commit to the innovation, disruptions are unattractive to the leaders because their best customers can't use them, and they promise lower profit margins. Therefore, investment dollars are always more likely to go toward next-generation sustaining innovations instead of disruptive ones. DEC's managers were not stupid; they were in fact very logical as they improved their company in the way it was built to operate.

This asymmetric motivation is precisely how and why disruptive innovations typically cause a dramatic change in the landscape of an industry. The Kodak camera, Bell telephone, Sony transistor radio, Ford Model T (and more recently Toyota automobile), Xerox photocopier, Southwest Airlines affordable flight, Cisco router, Fidelity mutual fund, Google advertising, and hundreds of other innovations all did—or are doing—the same thing.[2]

As a general rule, the vertical axis on the disruption diagram measures the type of improvement for which customers will pay more. One factor that makes it so hard for the incumbent leader to pursue a disruptive innovation is that the way product performance is defined in the disruptive market is antithetical to the sorts of improvements that are required to succeed in the original market. Making a better personal computer, for example, entailed making it smaller, cheaper, and easier to use. Making a better minicomputer generally entailed making it bigger and more powerful. The fact that the sustaining trajectory in the original plane of competition takes a company in a direction that is opposed to the direction of disruption makes life all the more difficult for the incumbent leaders.

APPLYING DISRUPTION THEORY TO PUBLIC SCHOOLS: DEFINING PERFORMANCE

In the private sector, the metric on the vertical axis of the disruption diagram is the type of improvement that merits premium pricing. But in the public sector, where we can also draw these diagrams, the political or societal importance of programs determines the metric on the vertical axis. Public agencies consistently move up-market, away from initiatives that are less politically important and toward those that are more important.

Public schools are, of course, public institutions. Some programs are intensely important in the communities schools serve, whereas others are less important. We explain in the paragraphs below that *schools actually have been improving*—moving up the vertical axis of their industry just like the companies in all the industries we have studied. In a manner analogous to disruption in the private sector, society has moved the goal posts on schools and imposed upon them new measures of performance. What is unique about public schools is that laws and regulations make them a virtual monopoly, which makes it difficult and sometimes impossible for new business models to compete on the new measures. Society has asked schools to pursue the new metric of improvement from within the existing organization, which was designed to improve along the old performance metric. In essence, the public schools have been required to do the equivalent of rebuilding an airplane in mid-flight—something almost no private enterprise has been

able to do. On average, however, schools have done just that—adjust and then improve on each new measure. But doing so has not been easy.

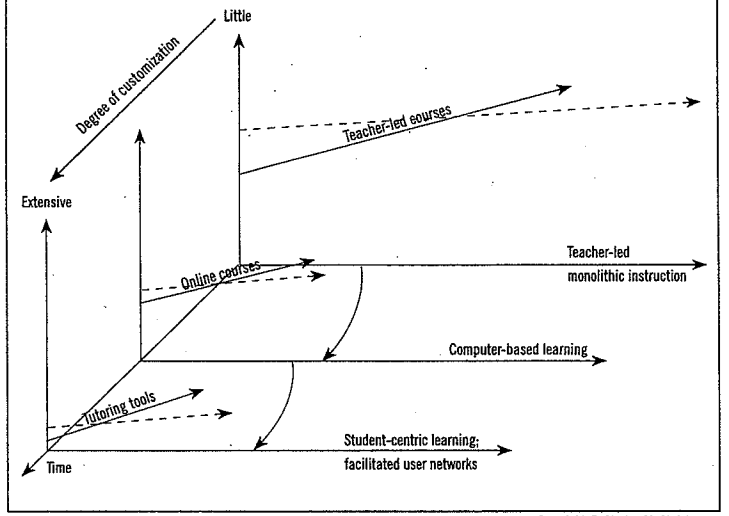
To obtain a fuller understanding of how society has tasked schools with pursuing new disruptive performance measures—in essence assigning them new, primary jobs to be done—we'll briefly step back into the history of public schools. In the description that follows, we frame the story in the context of the disruptive innovation model. Because it is a summary, we necessarily resort to generalizations that will mask important details and exceptions. But our aim is simply to provide some general context to understand how society and schools evolved over time.

❖ DISRUPTION TOWARD STUDENT-CENTRIC LEARNING

We state above that in the first phase of disruption of the instructional system the software will likely be complicated and expensive to build. The reasons for this can be traced to the use of the existing commercial system when marketing the software, as noted previously, as well as to the relative immaturity of Web 2.0 software. Within a few more years, however, two factors that were absent in stage 1 that are critical to the emergence of stage 2 will have fallen into place. The first will be platforms that facilitate the creation of user-generated content. The second will be the emergence of a user network, whose analogues in other industries would include eBay, YouTube, and dLife (for patients with diabetes and their families). The tools of the software platform will make it so simple to develop online learning products that students will be able to build products that help them teach other students. Parents will be able to assemble tools to tutor their children. And teachers will be able to create tools to help the different types of learners in their classrooms. These instructional tools will look more like tutorial products than courseware. But rather than being "pushed" into classrooms through a centralized selection process, they will be pulled into use through self-diagnosis—by teachers, parents, and students. User networks, not value-chain businesses, will be the business models of distribution. This will allow parents, teachers, and students to offer these teaching tools to other parents, teachers, and students.

We illustrate these stages of disruption in Figure 5.2 as successive planes of competition, where each plane comprises a commercial system. The rear-most plane of competition represents the present public school systems, as well as most private and chartered schools. They are characterized by monolithic instruction, as noted previously. Textbook development and production, school district adoption decisions, the systems of instruction, and assessment are all monolithic because customization is prohibitively expensive.

FIGURE 5.2 Characteristics of the two stages of disruption in content delivery



The middle plane, representing the first stage of instructional disruption that we call computer-based learning, takes root competing against nonconsumption. It is already underway and is being fueled primarily by the economics of the teacher-led model—by the inability of schools to offer the courses that students want or need to take, just as happened in our vignette when Maria wanted to take Arabic. The courses in this stage look a lot like the courses in the back plane in that they tend to be designed by and taught to people with the dominant type of intelligence in the field. They constitute complete courses and tend to be made and marketed by companies with value-chain business models.[4]

The front plane in Figure 5.2 depicts the second stage of disruption. As we discuss next, the products in this wave will

be user-developed online tools for *tutoring*. They will be distributed to students, teachers, and parents through a user network, not a value chain. Its products will be modular, which will make customization easy. In a manner analogous to the way that software developers can build their custom operating systems by inserting kernels of Linux exactly where they are needed, users will select these tutorial modules and then insert them, like "kernels," to augment and customize the courses to the learning needs of each different type of learner. Ultimately, people will assemble them together into entire courses whose approach is truly student-centric—custom-configured to each different type of learner.

The Technological Platform

Platforms that enable nonprogrammers to build remarkably sophisticated software for specific purposes (called "applications") are becoming increasingly common in software markets. One such platform is Intuit Inc.'s *QuickBase*, an online software platform that allows anyone to develop her or his own system to manage a small business's resources. Imagine, for example, that you were running the annual Girl Scout cookie sale for your state. You need to keep track of what orders have been submitted by each of thousands of Girl Scouts, for each type of cookie. You must keep track of who has sent in the money collected, and who hasn't. You must add the orders up and send the aggregate order to headquarters. You need to track them to ensure that the hundreds of thousands of cookie boxes are delivered, with exactly the right mix, to local leaders who in turn deliver exactly the right mix to each of the Girl Scouts' homes. You must ensure that the girls actually deliver to their customers the cookies they had ordered and that money is collected from customers who had not yet paid. You also must ensure that thank-you notes are sent to all the leaders for their volunteer efforts and that special rewards are given to those girls who achieved certain sales benchmarks. And, incidentally, you know nothing about software, and you have a family of your own to raise. This is a *very* complicated problem, but you cannot justify what it would cost to get an off-the-shelf enterprise resource planning software package from a vendor like SAP. But with QuickBase, you simply hop online and create the program for your unique needs.

Platforms of tools that are similar in character to QuickBase will enable nonprofessionals to create software that helps different types of learners master topics that they would otherwise have struggled to learn. These will be simple products at the outset, experimentally devised by those who live face to face with students' learning problems. These might come from a father of a mathematics genius; he has figured out why his daughter is such a horrific speller and doesn't seem to care, and he has devised a method to teach spelling to his differently wired daughter. These might come from a high school sophomore who barely understands Algebra 2 and yet has found a way to teach the concepts to her friend, who is struggling even more in the class. Or these might come from a history teacher, who, in do-or-die desperation, finally figured out a way to inspire her students to become inquisitive about the Spanish Inquisition.

Notice that these sound more like tools for tutors—and that's the point. We'd love for every student to be able to afford personal tutors who have the skill to tailor the way they teach each subject to their students in a manner that matches the way the students learn. But it's too expensive; hence, we've settled for monolithic instruction. These stage 2 tools disrupt the tutoring business; they can make it so affordable and simple that each student can have a virtual tutor through these tools. Over time, the modules that students, parents, and teachers employ to help students solve individual learning problems in individual courses will be combined into complete custom-configured courses—the consummate purpose of modularity.

Far-fetched? We don't think so. It's not just QuickBase that enables build-your-own software. A generation ago, it was inconceivable that anyone could create animated movies that could compete with Disney's artists. But digital animation

technology enabled Pixar to create *better* movies—to the point that Disney had to buy Pixar in order to stay in the game. Now the technology is making it so simple that *lots* of people can create their own animations. Check them out on YouTube. Second Life is a very popular online, three-dimensional world that is "imagined and created entirely by its residents."[5]

Distribution through User Network Business Models

The initial motivation for creating these tutoring tools could very well be "local"—for family, friends, or a teacher's own students to use. If history is any guide, however, the best of these tools will spread in popularity very quickly, and exchanges will emerge through which this user-generated content can be offered to others for free or a fee. By illustration, the software-as-a-service company Salesforce.com features an "AppExchange" on its Web site. There, people who have developed programs from QuickBase or platforms like it, can post the applications they have created, and other users can join and find applications that fit their needs.

Though still in their infancy, user networks such as these—user-generated, collaborative learning libraries through which participants worldwide can instruct and learn from one another—are emerging.[6] These networks will harness the innovative energies of a much larger group of insightful people than is possible in today's value-chain business models that dominate the creation and sale of traditional textbooks and their use in monolithic instruction. As these networks become known and platform tools for building these products become easier and easier to use, a user who figured out how to teach spelling to people strong in logical-mathematical intelligence could go to an exchange, develop a tool, post it, and see what happens. As content is used over time, users will rate it, as they rate books on Amazon.com and movies on Netflix, so that others can easily find the tools that match the way they best learn.

One insight that educators can glean from the health-care industry is that people are quite good at self-diagnosis

when they are given adequate tools. They often can feel their symptoms much more comprehensively and subtly than can be articulated to a doctor. That's why pharmaceutical companies have begun to spend so aggressively on direct-to-patient advertising for certain maladies. Historically, patients simply put up with disorders and discomforts because they did not know that there was a remedy for the problem. The advertisements that communicate that a solution exists typically also teach the patient about the problem. In the past, drugs were "push-marketed" through the professionals—the doctors—and patients generally received therapy if and when the physician prescribed it. Increasingly, patients are "pulling" the solution from their doctors after they've made a preliminary diagnosis themselves.

The analogous case in education is that historically, because they haven't known of the existence of remedies for learning problems, students and their families typically put up with poor grades and the low self-esteem spawned by feeling dumb. These user networks will be designed to help students and their families diagnose why they're finding it so difficult to master a subject and then find their own solution. Just as in health care, students and their families will not wait for their teaching professionals to prescribe a "therapy." They will pull the solution out of the user network themselves.

The Benefits of User-Generated Content

We mention above that these software platforms will enable students to teach other students by developing tools and putting them into the user network. Isn't it better to have the professionals teach, and the learners learn? No, not necessarily. We often learn better when we teach than when we listen to a teacher.

Consider this illustration of this principle. A friend of ours, whom we call Dan, studied accounting at a junior college in the western United States. Through intense effort he graduated with mediocre grades and somehow got himself admitted, on probation, to a nearby four-year university where he planned

to finish the final two years of upper-division courses required to earn a bachelor's degree in accounting. Married and 23 years old, Dan was a mature student who worked hard at his studies. But after his first semester at the university, Dan had logged a GPA of 1.5. His academic advisor called Dan into his office and asked, "What does your father do for a living?"

"He's a rancher," Dan replied.

"I think you should go home and work with your father," the advisor counseled. "You're just not cut out for university work. I've seen a lot of students just like you, and you'll be a lot happier if you do something you're good at."

Dan replied that he wasn't dumb and that he wanted to pursue a career in business. "You just watch me," he countered to the advisor. "I'm going to do well, and I'm going to graduate!"

Dan redoubled his efforts. By working 80 hours each week at his accounting homework, he graduated and remarkably got himself admitted to the university's Masters in Accountancy program—again on probation. By dint of extraordinary effort and willpower, Dan earned his master's degree.

A few weeks after Dan graduated, an accountancy instructor at the junior college Dan had attended became ill unexpectedly. While they were exploring whether there was anyone else in that small community qualified to step in to teach his courses, one of the faculty said that someone had told him Dan had earned his master's degree. "Maybe he'd come home and teach for us—at least for a year, until we can find someone else," he posited.

With no other options, the faculty agreed. Dan accepted the offer.

Dan recounted to us that as he began to teach accounting, "All of a sudden, I understood it! I had grunted through all those years as a student by sheer guts and willpower, memorizing all the rules. But I never understood why we had to do all of those things. As soon as I had to prepare for class and teach it, I understood it!"

We now have a language to explain what happened to Dan. His brain was wired to learn in a way that didn't match the standard approach by which accounting was taught. While many of Dan's fellow students digested the rules and the reasons quite naturally, Dan struggled because his brain just didn't work that way. But when he had to teach the same material, the only way he could do it was to format the rules of accounting in a way that was consistent with his intelligence type. When Dan had to teach the material, he was finally able to learn it well.

Most of us have had the experience that Dan had: we learn material much better when we teach it than when we're sitting passively in a classroom listening to someone explain it to us. That's why technologically enabling students to create content for this second stage of disruption will be so healthy for student-centric learning.

DISRUPTING REGULATED MARKETS: LESSONS FROM OTHER INDUSTRIES

Untold numbers of school reformers and philanthropists have bloodied themselves by bashing the barriers that bar change in the existing system. Changing the textbook adoption process, confronting the demand for standardization, and countering the power of teachers unions are just three of a litany of factors that have rendered change a seemingly hopeless cause for many. And yet disruptive change has swept through many other heavily regulated and unionized industries. How did it happen? Never did success come through a head-on attack against the regulations and network effects that constituted the power of the status quo. Rather, the disruption prospered in a completely independent commercial system outside the reach of regulators. Once the new commercial system had proven itself to be viable and better and the bulk of the customers had migrated to the unregulated system, its regulators responded to the fait accompli. Rarely has revised regulation preceded disruptive revolutions.

For example, Southwest Airlines didn't disrupt the airline industry by seeking approval in the early 1970s from the federal

Civil Aeronautics Board for discount prices on long, interstate routes. It began flying short routes within the state of Texas, where the federal regulators lacked jurisdiction. The rates and route structures of interstate trucking collapsed under their own weight in the late 1970s after corporations began operating their own truck fleets, which fell outside the jurisdiction of the Interstate Commerce Commission. The regulation of bank interest rates was toppled when Merrill Lynch—not a bank and therefore not regulated by the Federal Reserve—introduced its interest-bearing cash management account. We could cite dozens of comparable examples. In each case, markets that were dominated by entrenched competitors surrounded by powerful network effects and protected by regulation have ultimately given way to the fait accompli of a new network, and to efficient, safe markets that emerged by circumventing regulation. Head-on attacks almost never work.

In public education, the influence that teachers unions can wield over textbook and instructional software adoption decisions looms so large that many would-be school reformers have abandoned hope of significant change. We suspect, however, that when disruptive innovators begin forming user networks through which professionals and amateurs—students, parents, and teachers—circumvent the existing value chain and instead market their products directly to each other as described above, the balance of power in education will shift. Administrators, unions, and school boards will capitulate to the fait accompli of larger and larger numbers of students acquiring and using superior, customized learning tools on their own.

This also points to a road forward for those venture capitalists, foundations, and philanthropies that hope to invest with impact in education. Many of these have shied away from education software because development and large-scale adoption are expensive. If our assessment of the future is correct, it suggests that there are two types of investments that

can have great impact. The first is in the development of the technological platform that nonprofessionals can use to create student-centric learning tools. The second is in building and facilitating a user network. We suspect that many thousands of teachers, as individuals, will begin using student-centric tools that they find in these networks and will put content they develop onto the network for other teachers to use.[7] In powerful ways, the participation of teachers in these user networks will diminish the opposition of their unions to this transition to student-centric learning.

Facilitating student-centric learning through user networks, instead of through the value-chain system of curriculum adoption, satisfies the litmus tests of competing against nonconsumption. Teachers, parents, and students, who otherwise could not develop or market these learning tools, will now be able to do these things. Rather than expecting that in one fell swoop computers will be in and textbooks out, the user-generated tools will be used independently as tutorial tools. For several years, most teachers and students will still have conventional textbooks. But little by little, textbooks will give way to computer-based online courses—increasingly augmented by user-generated student-centric learning tools. The second, or student-centric, stage of this disruption will move to the mainstream when users and teachers start piecing together enough tool modules to create entire courses designed for each type of learner.

At some point, administrators, school committees, and teachers unions will recognize that even without explicit administrative decisions ever having been made, student-centric learning will have become mainstream. The substitution curve analysis in Chapter 4 suggests that this will happen in approximately 2014 when online courses have a 25 percent market share in high schools—six years from the date of publication of this book. Student-centric learning is not far away.

Conclusion

Twenty-five years later, Doug Kim, Jr., is one of some two thousand students at Allston Circle High School in southern California. The school bell now rings at 8:35 a.m. to indicate that the building will open in 10 minutes. The skinny sophomore dawdles in the parking lot. Talking to his band buddies about music class, he pulls out some sheet music and starts explaining parts of the rhythm to one friend. He knows it cold. They're excited enough for class that they actually head in early. Watching them from the blue doorway, Robert James can't help but smile. These gangly teenagers are so far from his own early educational experience that he can hardly believe it, even though he's been teaching for more than a decade.

"Hi, Mr. James!" a voice calls across the parking lot. He turns to see Maria, running toward him as usual.

"Hi, Ms. Solomon," he says.

"Whew! The kids just didn't want to get going this morning," she says.

"The ones here do!" he responds.

They head inside, Maria to her classroom and Rob to his. They teach in adjacent rooms, each one equipped with different technologies. Rob's music and art students, including Doug Kim and his entourage, are al-

ready starting their computers. In the next room, Maria's students are individually deciding whether to pursue foreign languages or sciences. Through the glass wall dividing their rooms, Rob sees Maria leaning over his own daughter, Sarah, pointing at the screen. This morning, over breakfast, Sarah had said that she was particularly excited about starting her personalized tutorial. Rob remembers when his friend in Japan was grateful for help practicing English. Webcam buddies are standard now, and education has become even more tailored, which has made students more enthusiastic. Like her dad, Sarah learns best through audio methods and repeated practice. Her touch on the screen stops and starts an Arabic movie, which provides grammatical breakdowns when she needs them. Across from her, her twin brother, Sam, repeats words that the program dictates, and then he writes them down.

In Rob's own classroom, Vanessa is showing Tim a program she's found that helps her read music. He'd been having trouble, too, as he repeated the same mistakes over and over again in his trumpet practice. The two had started the year at odds, but now, as the dark-haired girl leans over the football player's keyboard, Rob smiles at the intent look on Tim's face. Vanessa clicks, and the computer plays the line flawlessly. "You can set it to repeat only a certain number of times, so it's an aid instead of a crutch," she says. "You still have to learn to read it. But it'll tell you right away if you're wrong."

Tim sings the line into a microphone hooked up to the program, which duplicates his singing on a treble clef below the actual music. "You're holding the eighth note too long and starting it too late," Vanessa says, pointing.

Rob's own computer has finished booting up while he's been watching them. He navigates his latest find: last night, on the CustomLearning Network, he'd finally found shareware that answered Matt's problem with keeping the beat. If only he'd had this in college himself! Then taking up the drums wouldn't have been so hard.

These days, the classroom is kinder than it used to be. The students are together, but also allowed to stretch themselves. "To each his own," Rob thinks. They haven't made soccer practice virtual yet, but even that might be useful. Maybe he'll run that by assistant coach Doug Kim, Sr.? And to think, he'd nearly failed chemistry.

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Is this vision of the future far-fetched and impossible? Attempts at education reform throughout the years have yielded only begrudging progress. People have tried to reform the public schools directly. Others have sought reform through chartered schools. Many have seen computers as the salvation for schools. The list goes on. And yet we return again and again to the question of why schools don't get the results for students for which we all hope. Why would this time be any different? Should we quit trying?

No. Now is exactly the wrong time to quit. To understand why, let's review the five major messages in this book.

1. Few reforms have addressed the root cause of students' inability to learn. And most attempts have not been guided by an understanding of the root reasons for why the system functions as it does or how to predictably introduce innovation into it. Without this guidance, we've been destined to struggle. This also means, however, that we now have an opportunity for great progress.
2. School reformers have repeatedly tried to bash the system and confront it head-on. A major lesson from our studies of innovation is that disruptive innovation does not take root through a direct attack on the existing system. Instead, it must go around and underneath the system. This is how disruption drives affordability, accessibility, capability, and responsiveness.
3. If we acknowledge that all children learn differently, then the way schooling is currently arranged—in a monolithic batch mode system where all students are taught the same things on the same day in the same way—won't ever allow us to educate children in customized ways. We need a modular system.
4. Some of the places with the highest potential to circumvent the system and create a new, modular education system that facilitates customization are the emerging online user networks—the equivalent of the autonomous business unit we describe in Chapter 9. When the decision-making

process for what is adopted in schools is centralized, as it currently is, there are so many powerful political and other forces at play that it makes change and customization nearly impossible. But user networks will democratize development and purchase decisions to the end users in the system—students, parents, and teachers. Smart people will do smart things if we just enable them to do so.

5. Finally, to the extent administrators and school leaders want to implement these changes, they have to use the tools of power and separation. Using these tools is easiest in the chartered and private school sectors. This means that school committees and government officials need to view themselves as not being responsible for the specific schools that exist in their jurisdictions; rather they are responsible for educating the children in those areas. Systemic reform requires a systemic view—one that includes all schools. If indeed the charter for educators is to eliminate poverty by leaving no child behind, the homes in which children's fundamental learning capacities are forged are critical as well.

There are many actors with divergent interests in the world of public education. They range from administrators and elected officials at the local level to those at state and federal levels; from teachers to parents and students; from philanthropists to reformers and researchers; and from corporate executives to business school professors. With the above understandings in place, what does each of these actors need to do to affect these changes?

To the leaders in the schooling system—elected officials and administrators

Use the right tools to introduce change. Don't think that for some reason you will be exempted from the rules of organizational nature. In this world of deep disagreement among the participants in school systems about what they want and even deeper disagreement about how to get it, negotiation toward

radical change simply will not work. The tools of power and separation, though they seem foreign to leaders who have been schooled in consensus, are key pieces of the puzzle of education reform.

As you face budget crises and difficulty finding teachers, don't solve these problems by doing less in the existing system. Solve it by facilitating disruption.

It is the nature of the resource allocation process to preempt resources for new initiatives in order to feed the existing system. This means that each school should have one person—and, over time, an organization reporting to that person—whose sole job is to implement online courses. This person should be different from the chief information officer or information technologies officer for the school or district. She or he should have broad autonomy and report directly to the principal or district superintendent. She or he should not have responsibilities for the rest of instruction in the school, but instead should be free to take whatever steps are necessary to bring in online courses to help the children in the school have access to and find the classes they need. She or he also should be responsible for capturing the learning from this to make this a more robust process over time. This very well might look like a school within a school, but it will help give schools the organizational space they need to facilitate the disruption to move to student-centric learning.

Furthermore, don't kill the disruption by having online programs strip away funds from districts or compete as whole schools directly *against* the existing system. Don't place artificial limits on what students can take online or what teachers can build online either; if they need access to a class or want to create content and lessons, let them do what they need to do, what they want, and what works best for them.

To philanthropies and foundations

Help fund this disruption. Generous people and institutions have wasted enormous resources on innovations that well-tested

theories of innovation could predict would have little impact. Computers in conventional classrooms; dominant-intelligence software that assumes that all students learn similarly; pay-for-performance schemes for teachers; and descriptive research that correlates the attributes of schools or teachers with their average performance all will do little to improve schools. Similarly, the very *raison d'être* of chartered schools is architectural innovation. If the vision of their founders is to try harder to make conventional curricular architecture succeed, don't fund it.

Instead, fund research that helps us learn how different people learn; how to identify those differences; and how different students can best educate themselves and each other. Such investments will create inestimable and enduring value because this is the only way that learning will become intrinsically motivating to all those who need to learn. Prosperity, remember, is stripping schools of the extrinsic motivation that has driven so much of our learning in the past.

To entrepreneurs

Investing in technological platforms that will enable children to create tutorial tools for each other, that help parents to create tools for their children and others' children, and that make it easy for teachers to create tools for their students and for other teachers will have extraordinary impact. This is because we learn most deeply when we teach others. Funding the development of these platforms and the user networks within which these learning tools can be exchanged will be financially rewarding for investors and socially rewarding for philanthropists. Remember that students, parents, and teachers are desperate to be able to diagnose and resolve their own learning problems and teaching deficiencies. These are highly motivated people who in the past have been trapped in interdependent systems that stymie custom solutions at every turn.

To teacher training colleges

Continuing to train teachers to perform in a world of monolithic, teacher-led content delivery, where the key skills are in holding students' attention to subjects that are being taught to the dominant type of learner in each subject, trains teachers for the past. Future teachers will need the skills to work one on one with different types of learners as they study in a student-centric way. The tools that teachers build and distribute in the user networks of the future will play a key role in making learning student-centric. The next generation of teachers needs to learn how to build these tools for different types of learners.

To graduate schools of education

Progress beyond doing descriptive research that seeks average tendencies. Study the anomalies and outliers; that is where the richest insight can be found. Only by doing so can researchers see where we don't yet understand the causal mechanism, and where we have not categorized the world by circumstance to understand why an action worked one time but not another. Over time, what will emerge are circumstance-based statements that will help us make much better progress in the years ahead as we learn what each individual student needs, not what works on average for students in a school.

To teachers, parents, and students

When there are no courses available for a student at your school, seek them online and demand that your schools accept them for credit. When a student is struggling with a concept, seek the user networks that entrepreneurs are building to help locate a tutor or content online that can help that student. And when possible, create these tools yourself; don't be afraid to share them with the world. Parents should seek for their children at an early age exploration opportunities that they can do with their children at home and that are fun but that would also identify students' interests and learning styles and allow for the celebration of their uniqueness.

There is power in our communities to effect change. By disrupting the classroom as we now know it, we can break apart the fundamental obstacles with which educators, parents,

and students have struggled for so many years. These technologies and organizational innovations are not threats. They are exciting opportunities to make learning intrinsically motivating, that make teaching professionally rewarding, and that transform our schools from being economic and political liabilities to sources of solutions and strength.