Introduction

For over thirty years, I have examined the adoption and use of technology in the classroom (*Teachers and Machines*, 1986; *Oversold and Underused*, 2001; *Inside the Black Box*, 2013).[1] I looked at the policy hype, overpromising, and predictions accompanying new technologies in each decade. The question I asked was: *What happens in schools and classrooms after the school board and superintendent adopt a reform-driven policy of buying and deploying new technologies to improve schooling?* In books, articles, and my blog (https://larrycuban.wordpress.com/), I moved back and forth between policy and practice.[2]

In these decades, champions of digital technologies in schools have believed deeply that the traditional goals of tax-supported public schools—building citizens, preparing graduates for a labor market, and making whole human beings—could be achieved through new electronic devices. They believed that hardware and software would, if not transform, then surely alter classroom teaching; they would improve students' academic performance and prepare graduates for an entirely different workplace than their parents faced.

In my research during these decades, I described and analyzed computer use in schools and classrooms across the United States. I tracked how these high-tech advocates and donors were often disappointed in how little school and classroom practice changed in the direction they sought, the anemic results in student achievement, and uncertainties in getting the right jobs after graduation, given the claims accompanying these new technologies.

I also documented occasional instances where individual teachers thoroughly integrated laptops and tablets into their practice and moved from teacher- to student-centered classrooms. And there were scattered cases of schools and districts adopting technologies wholesale and slowly altering cultures and structures to improve how teachers teach and students learn.[3] I found these occasional exemplars of classroom, school, and district integration important, although puzzling in their isolation from mainstream practices.

LITERATURE ON DIGITAL TECHNOLOGY IN SCHOOLS

In doing all of this research, I became intimately familiar with nearly all that had been written about digital technology in schools.[4] Researchers, policy advocates, and practitioners have created an immense literature on access to, use of, and effectiveness of technology in schools and districts. However, this literature, particularly as it deals with effectiveness, is stacked heavily at the *success* and *failure* ends of a continuum. Academics call this clustering at either end of the spectrum a *bimodal distribution*, with many fewer studies at the center of the continuum than at either pole. In short, the spectrum has two peaks, not the familiar, normal *bell curve* distribution.[5]

In this distribution, *success* refers to studies, reports, and testimonials about how technology has improved teaching and learning. Between the 1990s and early 2000s, researchers, commission reports, and reporters accumulated upbeat stories and studies of teachers and schools that used devices imaginatively and supposedly demonstrated small to moderate gains in improving test scores, narrowing the achievement gap between minority and white students, increasing student engagement, and achieved other desired outcomes. These stories, often clothed as scientific studies (e.g., heavily documented white papers produced by vendors; self-reports from practitioners), beat the drum for more use of digital technologies in schools.

At the other end of the continuum, the *failure* peak comprises a collection of studies that show disappointing results in students' academic achievement, little closing of the gap in test scores between whites and minorities, and a lack of substantial change in teaching methods during and after use of new technologies. Accounts include tales told by disgruntled teachers, irritated parents, and disillusioned school board members who authorized technological expenditures.[6]

Hugging the middle between these peaks are occasional rigorous studies by individual researchers and meta-analyses of studies done over the past half-century to ascertain the contribution (or lack thereof) of technology to student and teacher outcomes.[7] But even with these studies, the overall literature has yet to develop a stable and rich midpoint between success and failure. I would like this book to occupy the center of this continuum by documenting both successes and failures of going from policy to practice in using new technologies in classrooms, schools, and districts.

Such a bimodal literature results from questions researchers, policy makers, and practitioners asked about access, use, and effects of digital technologies. Most of the reports and studies were initially interested in answering the questions of who had access, how devices were used in lessons, and whether they "worked" (that is, raised test scores and influenced academic achievement). The resulting answers created each peak. Other questions about computer use in schools, however, went unasked.

A FUNDAMENTAL DILEMMA AND UNASKED POLICY QUESTIONS

In reading the literature, I noticed that top decision makers and funders seldom acknowledged the essential dilemma facing policy makers seeking to alter how teachers teach: They are asking the very people whom they regarded as the cause of the instructional problem to put new and different classroom practices into their daily lessons. Reform-minded decision makers, policy entrepreneurs, researchers, and advocates for

this or that innovation—including use of new technologies—either dodged, neglected, or shunned this dilemma and the essential questions accompanying any new instructional policy.

But it is crucial to answer these policy questions if we are to understand the role that technology plays in public education when it comes to teaching and learning. And this is why I am writing again on the use of new technologies in classrooms, schools, and districts.

Reform-driven policy makers, entrepreneurs, donors, researchers, practitioners, and parents have sought substantial changes over the past three decades to transform schooling to improve student outcomes. Yet too often they either avoided the inevitable steps that need to occur for such changes to materialize in schools, or they skipped over the intricate interplay between the four basic questions that capture the necessary steps in going from adopted instructional policy to classroom practice:[8]

1. Did policies aimed at improving student performance get fully, moderately, or partially implemented?
2. When implemented fully, did they change the content and practice of teaching?
3. Did changed classroom practices account for what students learned?
4. Did what students learn meet the intended policy goals?

These straightforward questions must be asked of reforms aimed at improving student academic performance—creating small high schools, launching charter schools, adopting Common Core standards in states and districts, and instituting competency-based teaching and project-based learning. Most important for this book, these questions pertain not only to making digital technologies accessible to every student but also to expecting teachers to regularly use those technologies in lessons. To current advocates of using technology to transform teaching as, for example, personalizing learning, these questions are must-asks.[9]

Question 1 concerns the vital first step of actually implementing a policy adopted to improve classroom practice and student outcomes. Reform-driven instructional policies are not self-implementing.

Achieving policy aims requires leadership, political support, resources, technical assistance, staff development, and cooperation between administrators and teachers. Because teachers are the classroom gate-keepers—the ones who actually put a policy into practice—ample and clear evidence that teachers are in fact implementing new programs is key. If a policy is not being fully or moderately implemented, there is not much sense in pursuing the other questions. Evidence of teachers putting intended policy into classroom practice is essential to determining the degree to which an instructional policy is effective (or ineffective).

Once a policy's implementation in schools and classrooms is proved, then it is time to ask question 2: *Have teaching practices changed?* This linchpin question gets at the nexus between teaching and learning that is taken for granted in US schools: *Improve teaching, and then student learning will improve.* This has been the belief (or theory of action) driving reform-minded policy makers and leaders of university-based teacher education programs seeking to improve student outcomes since the introduction of tax-supported public education nearly two centuries ago. Determining the degree to which teaching practices have changed in the desired direction and which have remained stable is indispensable in moving from policy to practice.[10]

Question 3 closes this circle by getting at what students have actually learned as a consequence of altered teaching practices. In the past half-century, federal and state policy makers have adopted numerical measures of desired student outcomes (e.g., test scores, graduation rates, attendance, engagement in lessons) and established account-ability structures to secure these outcomes. These measures, however, assume that teaching practices have indeed changed in the desired direction. Evidence of such changes is required.

Question 4 returns to the immediate, midterm, and long-term purposes of an adopted policy. It asks for an evaluation of its intended and unintended outcomes. Immediate purposes might have concentrated on annual student test scores and high school graduation rates. Midterm purposes perhaps sought college completion rates and graduates' annual salaries a decade after completing school. Long-term purposes

look for achievement of overall goals for tax-supported public schools such as civic engagement, job and career history, measures of individual independence, and mindful participation in the community.

ARGUMENT

My reasoning begins with the tight linkage between policy makers' adoption of reform-driven policies aimed at altering how teachers teach, their implementation, and changes in teaching practice—the first two questions. Without classroom changes in the desired direction—the final two questions—student learning remains largely untouched. Thus, looking carefully at those instances where technology use in classrooms, schools, and districts has become common and praised for its seamless integration into daily lessons can get at determining what happens in classrooms. Such studies, combined with other examples of stability in practices and failed classroom use, can inform those eager to leverage computers in improving teaching practice and student learning.

The essence of my argument is contained in two questions:

- Have classroom, school, and district exemplars of technology integration been fully implemented and put into classroom practice? (See the appendix for how I define *exemplary* and the criteria I used to identify teachers, schools, and districts in Silicon Valley).
- Have these exemplary teachers, schools, and districts altered classroom practices?

To answer the first question, I look at instances of where individual teachers, schools, and districts in Northern California have fully implemented programs that integrated devices and software into daily practice. Some of these exemplars are clearly part of larger policy-driven reform efforts to improve schools over the past three decades. They include charter and traditional schools where expanded parental choice has produced a marketplace of school options. The instances I

have selected aim at helping students learn more, faster, and better in particular classrooms, schools, and districts. Answering this question will unfold various meanings of the phrase *technology integration* in these best cases and explore what has happened to these efforts—whether they have become permanent in schools and districts or eventually faded away.

The second question asks whether such exemplars have led directly to desired changes in classroom practice—and it's one that policy makers and major philanthropists too often fail to ask. Determining whether and to what degree teachers have altered their routines, embraced changes in content and skills, and displayed these changes to students and observers is harder than one might expect. First, instructional policies seeking to change teaching practices do not necessarily mean improved lessons. Improvement is in the eyes of the beholder. Surely, a mother and father divorcing and having joint custody of their children is a change. Whether it is an improvement depends on who makes the judgment: the parent who initiated or opposed the proceeding or the children. Evidence of change in schools, depending on the interpreter, can mean improvement. But it may simply mean making changes to maintain stability in existing practices—not an outcome most policy makers or donors would applaud.[11]

There is also the teachers' frequent answer to the above question: "Yes, I have changed how I teach as a result of using these new technologies." A researcher or policy maker may disagree after observing those teachers in the classroom. Moreover, discrepancies in answers may result from differences in how researchers, policy makers, and students define "change" in teaching or what policy makers want as a result of shifts in classroom practices. Spelling out these different perspectives on changes in teaching is necessary before this question can be fully answered.

In this book, I will refer to student outcomes (one measure of improvement) and the degree to which changes in teaching practice are connected to short-term gains in test scores, graduation rates, and the like. However, I will not investigate the degree to which teachers,

schools, and districts produced these short-term outcomes or how they did it. Focusing on student outcomes is another book unto itself.

WHY SILICON VALLEY?

This book's focus, then, is on the degree to which district instructional policies directed at teachers integrating digital technologies have altered daily classroom practices. Without such changes in practice, linkages to student outcomes become a story of other factors affecting how students perform academically. The place that I have looked for these exemplars is in Silicon Valley (the San Francisco Bay region stretching from south San Jose to north of San Francisco and across the water to the East Bay running from Berkeley to Milpitas in the South Bay). The area is home to over 3 million residents, of whom nearly two-thirds are minority. The median household annual income is over $110,000 (far higher than state and national averages). It contains seventy-seven school districts in four counties with over eleven hundred elementary and secondary public schools.[12]

Why here? The short answer is that these schools are located in the birthplace of computer hardware and software. Apple, Cisco, Intel, Google, and Facebook, whose names and icons have become internationally familiar, began and grew in the Valley. The area is characterized by technological innovation, a can-do spirit, and an entrepreneurial culture that prizes creating new devices, software, taking risks, and creating "unicorns"—a culture that encourages people to "think different" and to "make the world a better place." Silicon Valley has become the epicenter for technological progress.[13]

Another reason I've chosen the original Silicon Valley is the pervasive, heady optimism that digital technologies will improve life in general and education in particular. The ever-present social and mainstream media that hype each new "next thing"—from Google Glasses and driverless cars to home robots—breed a widespread, upbeat climate, implicitly demanding that schools keep pace with the innovations spilling out of Valley start-ups and established companies. Observers, then,

might expect schools in Silicon Valley to have far more access to and extensive use of new technologies than most other locales.[14]

A longer answer to the question of why I chose Silicon Valley involves an in-depth look at the youth-driven work culture of these companies, the wealth that has accrued in the Valley, along with sharp demographic changes and gentrification of once poverty-wrapped neighborhoods, the impact of these companies on the labor market, and growing inequality in incomes that characterize this multicounty area. It is a region of deep economic, social, and political contrasts shaped in part by the growth of this technological cornucopia.

An extended answer also encompasses how the work culture, innovative spirit, and entrepreneurial risk-taking characteristic of Silicon Valley have spread to Austin, Denver, New York, Boston, and dozens of other places across the United States. Now Silicon Valley has become a metaphor for far-flung places where investors risk their monies on start-up companies promising the next best thing, the "killer app" that will make a fortune for its investors and first-generation employees and, of course, "make the world a better place." The long answer to the question getting into the innards of Silicon Valley has been fully explored by others. I will stick to selected classrooms, schools, and districts in the Valley.[15]

Reforming public schools is seldom far from the agendas and talking points of Silicon Valley CEOs and billionaires who made their fortunes here. They want public schools to be stronger than they are now and a pipeline of knowledgeable and skilled employees. They have shown concern and about what happens in classrooms, schools, and districts. Nor have they been shy in funding both public and private schools in and out of Silicon Valley.[16]

So this is why I selected Silicon Valley schools. I reasoned that most residents, visitors, and workers would expect intuitively that in the mecca of technological innovation for the nation, schools would have not only integrated the newest of the new devices and software but also benefited from access to the expertise, products, and dollars these internationally acclaimed corporations (and start-ups) have created.

And many local districts and schools have indeed profited from this proximity. School districts in Silicon Valley, for example, have received free beta versions of computer products for decades since 1984, when Apple's Steve Jobs donated one Apple II machine and software to each of over nine thousand schools in California. A slogan plastered on walls in Facebook's Menlo Park site captures the spirit of getting software and devices out the door to consumers: "Done Is Better Than Perfect." New devices and software have been tried out in these districts time and again.[17]

More recent examples of both gifts and collaboration include Google's donation of $600,000 to over six hundred teachers who requested grants to help them in their classroom—from funding an Oakland teacher to buy graphic novels to help his students read to buying tablets and a whiteboard.[18]

Facebook's relationship with Summit charter schools (seven schools in the Bay Area) provides another example. Since 2014, Facebook's software designers have met with Summit principals and teachers to create a "next-generation model of personalized, student-directed learning for the US public school system." Facebook's support and assistance come at no cost to Summit.[19]

Or consider Milpitas Unified School District, at the southern end of Silicon Valley. This nearly ten-thousand-student district of largely low-income and minority students introduced blended learning through teachers and administrators that took advantage of high-tech devices and software and models easily available in the Valley. District superintendent Cary Matsuoka launched the design process in 2012 and, with a coalition of parents and supporters of the school, convinced district voters to pass a $95 million bond referendum to build new schools, renovate old ones, and underwrite an effort to integrate technology across all schools.[20]

Schools in Silicon Valley, then, have benefited from the resources available, the climate of techno-optimism that pervades the region about change being an unalloyed "good," and access to beta products, software engineers, and money. Many districts and schools, both new

and old, have adopted instructional policies geared to altering traditional classroom practices.

CHANGE AND STABILITY IN SCHOOLS

With all of these changes occurring in Silicon Valley schools, keep in mind that changes in public schools are historically embedded in an institutional contradiction.[21] In their multiple goals, public schools are both committed to change and stability. To understand the relative slowness of US schools, even in Silicon Valley, to embrace and deploy new technologies, I need to elaborate further this important and historical contradiction. Although schools are essentially conservative institutions committed to preserving core community and national values, they are also committed to changing individuals and improving society. The Valley's ubiquitous technological optimism pressures schools to embrace new ideas and practices. Because voters and taxpayers provide funds for public schools and parents, many of whom work for Silicon Valley companies, they want modern equipment in schools that can prepare children and youth for an information-driven workplace while instilling and reinforcing family and community values. So here, enthusiasm for transforming classroom practice spills over districts, leading many (but far from all) educators to accept beta versions of new software, buy laptops and tablets, and call for teachers to use devices and software in their daily lessons. It is this inherent paradox of change amid stability that explains the robust hold new devices have on Valley parents, teachers, students, and voters.[22]

For all of these reasons, I will focus on public schooling in Silicon Valley, particularly those classrooms, schools, and districts that have created exemplars of integrating technology into daily practices, places where technology is no longer in the foreground of teaching and learning but in the background, helping teachers and schools meet Common Core standards and skills needed for students to graduate high school and enter college or a career.

THE CALIFORNIA SYSTEM OF SCHOOLING

But Silicon Valley is not an island; it is part of California's state-funded and policy-driven system of schooling. A few words about that state system give a sense of the larger context in which Valley districts and schools operate.

In the 1950s and 1960s, California schools offered staffing and services that few places in the country could match: counselors, arts programs, school libraries, access to medical services, after-school programs, and other benefits that could turn out-of-state educators green with envy. State residents could go to two-year community colleges, four-year colleges, and universities virtually cost-free. What sounds like a "golden age," however, was far less glowing for most Mexican immigrants and blacks, who received inferior schooling even in those flush times.[23]

But times changed.

Today, California has eleven hundred districts with ten thousand schools enrolling a predominately minority 6 million students. Overseeing those students are nearly 300,000 predominately white teachers. In a few decades, California's schools sank to the bottom of national rankings in high school graduation, funding, and class size, among others. California ranks:[24]

1st	Number of students
4th	Teacher salaries
33rd	High school graduation rate
43rd	Per-pupil expenditures
49th	Students per teacher[25]

Most accounts of both successes and failures of California public schools target 1978 as the turning point. During Jerry Brown's governorship, state voters approved Proposition 13, which radically changed the assessment of property taxes, reduced the allocation of monies for public schools, and moved funding and policy-making authority from local school boards to the governor and legislature.

Soon after Prop 13 passed, decline set in. Schools went downhill fast, startling long-time residents.[26] Not only did property tax revenues for schools fall, but the state's economy went into recession. At the same time, immigration from Mexico, Southeast Asia, and elsewhere climbed sharply, increasing the numbers of children attending public schools. Subsequent governors and legislatures further reduced spending on schools, resulting in staff cuts, larger classes, decaying buildings, and erosion in academic achievement across the state, including districts in the emerging Silicon Valley. Unsparing blasts of criticism from civic and business leaders about the declining quality of schools further eroded public confidence in the public education systems.[27]

Amid the backlash over Proposition 13 and lack of school resources, Bill Honig ran for State Superintendent of Public Instruction on a platform of turning around the state's schools, preaching a gospel of traditional schooling. Anticipating the *Nation at Risk* report, he pressed for rigorous academic courses, a coherent state curriculum, and more academic demands on students and teachers. His reform message resonated with corporate leaders, parents, and ultimately voters—not once, but three times. Elected in 1982 and reelected in 1986 and 1990, Honig launched a subject-centered reform movement heavily endorsed by the state's business community, including tech entrepreneurs in Silicon Valley, that yielded higher and more graduation requirements, new curricula, and state tests tied to curriculum requirements. He also was instrumental in getting a fiscal floor for school funding into the state Constitution (Proposition 98).[28]

Between Proposition 13 and Honig's reforms, California became a more tightly aligned system of state-funded schools that hewed more closely than before to what governors and legislatures could agree on for the schools, such as new graduation requirements, state curriculum standards, and accountability. Successive administrations initiated reforms mirroring their values and voter wishes. That rollercoaster of reforms occurred every time there was a political change in Sacramento. It has persisted into the twenty-first century, even as the state's school

population became predominately minority and academic performance in the eight large urban areas deteriorated even further.

The dream of putting new technologies into California schools and thereby revolutionizing teaching and learning appealed to corporate leaders and public officials from both political parties. Here was an instructional policy that political leaders and the California Business Roundtable endorsed sufficiently to pry open the public purse. As State Superintendent of Public Instruction Delaine Eastin put it in 1996:

> Technology is an essential part of education as we approach the twenty-first century. Ninety percent of the jobs created from this moment on will require advanced technological training. To compete for these jobs, our children will have to be skilled in the use of information technology . . . If we allow our educational system to fall behind the tide of change in the larger world, we prepare kids for bit parts at best. As the marketplace changes, so do the skills that all students require. Today, the want ads for coal miners in Pennsylvania call for laptop computer skills.[29]

With economic prosperity producing budget surpluses, California lawmakers authorized ever-larger appropriations for schools to get wired, buy machines, distribute software, and train teachers to use the equipment in their classrooms. Silicon Valley entrepreneurs rushed to deploy new technologies. In 1997, Governor Pete Wilson and the legislature appropriated over $100 million for the first year of Digital High School grants, equal to $300 per student, to install computer networks in each of the state's 840 high schools over the next four years.[30]

Few California reforms have seen such a powerful yet loosely connected coalition of public officials, corporate executives, parents, and educators who agreed on the task of getting teachers and students to use computers in schools. And nowhere has that coalition support for such disparate purposes of making schools more productive, revolutionizing teaching and learning, conserving traditional values, and securing skilled workers attained virtual unanimity than in Silicon Valley.

The school reform rollercoaster continued in the initial decades of the twenty-first century. Since 2011, for example, when Governor Jerry

Brown returned to Sacramento, the State Board of Education, superintendent of instruction, and a friendly state legislature have enhanced funding formulas to increase money for schools and students, decentralized budgetary and staffing decisions previously exercised by state officials back to districts, and pushed for more integration of technology into teaching and learning.[31]

The context, then, for understanding what happened in Silicon Valley before, during, and after the surge of technology enthusiasm requires knowing that the state of California and its governor, legislature, and state superintendent have enormous influence on the funding and policies that guide what over a thousand districts, including the seventy-seven in Silicon Valley, do in their schools and classrooms.

OVERVIEW OF CHAPTERS

Two central questions guide this study of exemplary classrooms, schools, and districts in Silicon Valley that have made technology a seamless part of their lessons. In part 1, I focus on the first of these questions: *Have classroom, school, and district exemplars of technology integration been fully implemented and put into classroom practice?* To answer this question, part 1 looks at exemplars of integrating computers into classrooms, schools, and districts in Silicon Valley. (I have included an appendix that defines what an *exemplar* is—that is, criteria determining "best cases"—and how I recruited teachers and administrators to open their classrooms, schools, and districts to me. I also lay out the pros and cons of the methodology.)

In chapter 1, I present selected vignettes of forty-one teachers I observed who integrated digital technologies into lessons. Analyses of these exemplary teachers document their determined efforts to acquire resources, design lessons, and implement them within their classrooms. These Silicon Valley teachers will be compared with national surveys and case studies of teachers who have integrated technologies into their lessons in low-income to affluent schools.

As complex as it is for an individual teacher to mix daily use of high-tech devices and software into routine classroom practices, technology

integration across a school is even more complex. In chapter 2, I explain why that is (e.g., changes in structures and cultures) and then segue to schools I observed in Silicon Valley that have integrated new technologies across the entire school, expecting teachers to teach lessons using particular hardware and software. Descriptions of teachers and analyses of these schools will comprise most of the chapter. I end the chapter by synthesizing national research studies of other schools that have also integrated new technologies and compare and contrast them with those I have analyzed.

Chapter 3 considers the technology integration programs at the district level. The difficulty of integrating technology into individual classroom work or whole school policy pales in comparison with trying to get an entire district's structures, culture, and activities to seamlessly—without any dropped stitches—act as a unit in integrating new technologies into instruction across many schools and hundreds or more classrooms. While most US districts have "technology plans" for using computers to make administration and instruction more efficient, only a few have fully implemented their technology plans and actually built the infrastructure and culture, tying both to curriculum and classroom instruction, while also creating professional development for teachers to implement integrated practices into classroom lessons (e.g., Mooresville, North Carolina). Through the history of two districts, including vignettes of lessons, I concentrate on how a school system integrates technology across its classrooms.

In chapter 4, I identify one of the overriding purposes of instructional policies pursuing technology integration: creating personalized learning, or the tailoring of individualized lessons to differences between students. I place the exemplars of classrooms, schools, and districts described in chapters 1 to 3 in the context of historical and contemporary struggles among reformers (the two wings of educational progressives then and now) over how best to school America's children and youth. I then create a continuum of personalized learning and locate the classrooms, schools, and districts I visited in 2016 along that spectrum. I explain how these "best cases" of integrating technology contain

features that were apparent a century ago, when reformers struggled over how schools should improve (e.g., efficiency-driven versus whole child reformers). I then compare and contrast past and present reform efforts to highlight how technology integration today in the Silicon Valley embodies arguments between reformers then and now. I end with a discussion of the paradoxical issue of stability in practice amid obvious changes.

Part 2 explores the second critical question addressed in the book: *Have these exemplary teachers, schools, and districts altered classroom practices?* Turning an instructional policy into practice is a long drawn-out process and requires hard work on the part of both administrators and teachers. And what occurs in classrooms is not always what policy makers and administrators expected. In looking at "best cases" in Silicon Valley, technology integration had already been put into practice and what I observed and heard spanned both rhetoric and action.

Chapter 5 summarizes the results of teachers responding to my questions: Has technology changed how you teach students? If yes, how? If no, why not? I explore the near unanimity among my sample of forty-one teachers that they have altered (and "improved") their practice and in what ways they have made changes. I then explore the differences between a teacher's perspective about what constitutes change and "improvement" and the perspectives of researchers, especially historians, who see the same classroom and answer the questions differently.

This chapter gets at the complexity of the question of what *change* means when it comes to classroom practice and how different criteria teachers and researchers use come into play; continuity in some practices and changes in other complicates any answer to the question. Nonetheless, I offer an unambiguous answer to the question.

Finally, I review the accumulated changes I have seen in Silicon Valley at three organizational levels.

Chapter 6 summarizes the degree of change and stability in my sample of Silicon Valley classrooms, schools, and districts that have been designated exemplars of integrating new technologies into lessons. I answer succinctly the two central questions that I asked at the beginning

of the book. Finally, I ask the "So what?" question and look at the policy implications of these findings for reform-minded decision makers, practitioners, researchers, and parents: *Have new technologies "succeeded" or "failed" in altering lessons that teachers typically teach?* I end in pointing out that the path of school reform using new technologies is closer to the flight of a butterfly than the path of a bullet.

If policy implementation occurred (the first four chapters) and if classroom practices changed (which I take up in chapters 5 and 6), then the meshing of new digital technologies into daily lessons made a difference in how these teachers taught. And if teaching practices did, indeed, change, then whether these altered practices made a difference in student learning becomes the next big question. While I will not answer that question in this book, determining what has changed in daily lessons in these "best cases" of classrooms, schools, and districts is the critical question that all reform-driven policies aimed at altering how teachers teach must answer first.