CITY CHARTER HIGH SCHOOL
BEST PRACTICE BRIEF

This document is part of a series of best practice briefs that provide a close-up view of how innovative educational strategies are implemented at a highly successful urban charter high school.

Integrating One-to-One Computing

Catherine Awsumb Nelson, Ph.D. June, 2011

City High

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What is one-to-one computing?

Everyone—staff and students—at the school has a laptop computer, it goes where they go, and is the primary tool they use to do their work, to communicate with each other, and to manage information.

Contents

This document is part of a series of best practice briefs that provide a close-up view of how innovative educational strategies are implemented at a highly successful urban charter high school.

Other briefs in the series, examining looping of teacher-student teams from 9th to 12th grade, cultural literacy and competency-based staff promotion are available at the school's website: www.cityhigh.org.

A note on data sources and methodology

This series of best practice briefs is produced by Catherine Awsumb Nelson, Ph.D., an independent evaluation consultant who has worked with City High on research, data, and evaluation issues since the school's founding. In addition to City High, Dr. Nelson's current and recent clients include the RAND Corporation, the Ball Foundation (Chicago), Pittsburgh Public School District, The California Endowment, The Heinz Endowments, Boundless Readers (Chicago), and the W.K. Kellogg Foundation. Her work focuses on helping educational institutions incorporate evaluation information into their decision making and organizational routines to foster data-based decisions about programs, resources, and performance.

At City High, Dr. Nelson worked collaboratively with the school leadership team to design an annual school report card that presents trend data on a range of school goals including academic achievement, post-high school transitions, and positive school culture. Some of the data from that report card (available on the school website **www.cityhigh.org**) come from annual surveys of students, parents, and staff that Dr. Nelson designs and administers. In addition to producing the annual report card, Dr. Nelson has worked with school leadership to investigate specific issues of interest including the transition from 9th to 10th grade and the factors that support successful student buy-in.

The topics for these best practice briefs were selected in consultation with the entire school staff to represent the consensus view on the school practices that are most innovative, effective and of potential interest to other educators. Some of the data in the briefs is drawn from the ongoing school evaluation, including survey data and a series of intensive student case studies in which twelve students in the school's first cohort were interviewed in depth three times in each of their four years at City High. Additional topic-specific interviews were conducted for each of the briefs, typically including two or more of the school's administrators, four or more faculty with specific experience/perspective on the topic at hand, and a sample of twelve or more students. All interviewees were promised anonymity.

All of the quotations (indicated by italics) in these documents are the actual words of City High students and staff. In the case of the vignettes presenting student and staff perspectives on the topic that lead each brief "What does it look like at City High?", the words of multiple interviewees have been melded together into a composite. All other quotations in the briefs are from individuals.

What does it look like at City High?

James, a senior at City High, jumps off the city bus that brings him downtown each morning and hurries onto the elevator to the 9th floor. With fifteen minutes before his first class, he opens up his laptop and quickly scans his e-mail for news on the college scholarships he has applied for. Nothing today. There are, however, dozens of e-mails from fellow students wanting to participate in the Valentine's Day flower sale he is coordinating as a fundraiser for the senior trip to New York. James clicks open Excel and logs the new orders into the spreadsheet he has created.

Sitting down at one of the long tables in his first period Cultural Literacy class, he gets right into the morning routine. He opens up his Edline page, where he can see all of his grades and attendance records and links to pages for each of his courses. Clicking over to the homepage for 12th grade Cultural Literacy, he finds that day's assignments. As the teacher makes a short Power Point presentation on the New Deal, James type notes directly on the slides that he downloaded from the Edline page and saved to his hard drive. From a list of related topics to explore in more depth, James selects the Civilian Conservation Corps and clicks on links to suggested sources online. He reads several of the articles, watches a video clip, and also finds some background and definitions in the encyclopedia installed on his hard dive. He types his findings into the notes template provided on the Edline page and uploads his work just as the teacher is pulling the class together for a discussion of common themes in what they found.

As always, math class begins with a "warm-up"—today it is an online quiz. Before the end of the period, the teacher has analyzed the data and given James and the other students homework problems targeted to their weak spots.

Over lunch, James shows off the new animated schematic he has added to his senior project webpage on industrial applications of robotics and reads a new message with some suggestions has from his outside mentor at the robotics company where he did his 11th grade internship.

As he settles into his seat in the science lab, James checks the discussion board for his honors section, where several students have added new posts on the teacher's original question about the privacy of genetic data. He makes a mental note to log on and respond tonight. Laptops are closed during today's lab work, opening up again as the period ends and students enter the data they have collected and will graph as homework

Before heading home, James looks at his Edline page again, and notices something not quite right about his rolling average in math. Clicking into the specifics, he notices a zero recorded for an assignment he is pretty sure he turned in. He quickly e-mails the teacher, grimacing at the thought that his mother may be sitting at work at this very moment looking at that same big fat zero.

Getting off the bus near home, James notices students from the neighborhood high school staggering home under backpacks loaded with textbooks and thinks gratefully that everything he needs

for tonight's homework is either right on his slim laptop or out there on the Internet.

How does City High do it?

At City High, 1-to-1 computing is integral to educational, communications and management practices.

As an **educational tool**, laptops serve as textbook, notebook, and library. Students receive, complete, and submit most assignments using their laptops. They use them to take notes, to collaborate on group projects, to conduct research, to pose questions to teachers. They use them to gather and analyze data and create displays of their findings. Every member of the community has a home directory to save work on the server and teachers and students use them constantly. Putting these kinds of tools in the hands of every student all the time is fundamental to City High's insistence that students take ownership of their learning—**these tools enable them to play a more active role in their own learning, do more of the work.**

A Social Studies teacher describes how she has students use their laptops to open up the traditional teacher lecturing/students taking notes class format and keep the students constantly engaged with and processing the material: *"Even when I am presenting factual information, I use a PowerPoint. I post a student version of it on the Edline page for the course, and students take their notes right on it. I'll have blanks missing and questions they have to answer along the way. At the end there are a few broader reflection questions they have to answer. They upload the version with their notes so I can check understanding and then they also have it to study with."*

In the classroom, technology changes not just pedagogy but the fundamental nature of curriculum, allowing content to be far more flexible and responsive to student needs and interests. It is important to understand that City High does not teach "cyber courses," which tend to be traditional content presented on a new platform. And the school is not using educational software like tutoring programs, which maintain the same tightly controlled and structured relationship between the learner, the teacher, and the content. City High's approach is to equip students with the same powerful research and productivity tools they would find in a professional workplace. Instead of investing in quickly outdated textbooks, City High's curriculum encompasses the latest information. Although textbooks are still a part of the curriculum in subjects such as Spanish, math, and science, technology integration ensures that textbooks do not become the curriculum.

To understand how technology is used to advance the learning goals of different disciplines, compare how City High uses it in social studies and the sciences.

- In most of City High's social studies courses, students have the laptops open throughout the period. In the study of history and society, the school has chosen not to limit their students to the set of facts contained in any one textbook. Technology gives them access to artifacts, archives, news articles, video records of important events. The teachers provide the fundamental organization for the course, a structure of critical themes and ideas, essential questions to be investigated, and skills to be developed. The students use those questions as a starting point to research, access, and read primary documents, manipulate information, and write about their conclusions. A 12th grader comments: *"History is really project based. You are learning on your own a lot, on a project you have chosen. Even if we are reading from a book we are always going online to find out more depth and detail, answer questions that come up."* Teachers have found that social studies also lends itself well to online discussion boards as a supplement to or continuation of classroom debate. As one teacher comments, *"online discussions are a great way for getting the quiet kids to talk, for allowing everyone to participate."* And a 12th grader gives what is surely a high compliment for academic coursework when he notes that the discussion boards are *"kind of like Facebook—you post and respond, chat back if you disagree."*

- Laptops tend to be used less constantly and differently in most of City High's science courses. The sciences are fundamentally different in that students need an organized way to learn a new vocabulary of terms and the textbook provides that. Also, much of the work is hands-on experiments and investigations, as in the school's forensic science course. Technology is used to deepen understanding—through accessing simulations of cutting edge experiments, analyzing and graphing data, and producing reports.

In every subject, **a technology-based core curriculum also allows learning to be differentiated to the needs and interests of individual students.** When course content is not bounded by a textbook, teachers can design assignments so that students meet common learning goals while pursuing their choice among a broad range of topics. Online assignments are easily customized to provide "extra steps." links to more sophisticated resources, or opportunities for interactive discussion for more advanced students. City High's fully integrated special education students may receive slightly more structured versions of the same tasks, with in-classroom support from special education teachers and paraprofessionals.

The graduation project, culmination of City High's research curriculum and embodiment of the school's goal that every student be able to design and conduct independent work, brings together many of the hard and soft technology skills students have learned over their years at City High. In 11th grade, as students are beginning to design and frame their projects, they post daily to their senior project blog, where the research teacher can leave comments and suggestions. Students also must create a website for their project, which develops with the project to include links to the research they have used, photos and video clips, any data and documents they produce. Online research is an important underpinning of almost every student's project and many of them design and conduct online surveys. When students make their final presentation to a review team including an outside expert, the caliber of their PowerPoint and webpage and how well technology has been

used to support the goals of the project all figure into their final grade.

As a **communications tool,** technology is just how business gets done at City High. Co-founder Richard Wertheimer admits, *"We more or less force people to communicate this way."* The most powerful lines of communication are teacher-to-teacher and between teachers and administrators. Members of grade-level teaching teams are instantly aware of the academic or disciplinary issues of any of their students. Although most discipline is handled on the floor by the grade level team, when a student is sent to the office, information about the situation arrives there before he does. And in talking through a problem with a student, an administrator can call up on screen anything from the student's tardiness record to that morning's quiz grade. As an administrator, Wertheimer is on every distribution list and estimates that he receives between 80 – 120 internal e-mails a day: *"Most of these I just glance at and delete, but it is a way for me to keep my finger on the pulse of what is happening throughout the building."*

As a **management** tool, City High's technology infrastructure is a powerful means of gathering, organizing, analyzing, and acting on data. Short surveys, on everything from prom themes to parent satisfaction, are frequent and produce immediate turnaround and reporting. Questions that might otherwise be idle speculation get hard answers: Which ten kids have been scoring the lowest on vocabulary quizzes? Are they struggling with other kinds of assignments? In other subjects? Does this student's QPA reflect what his EXPLORE scores suggest are his potential? Are there attendance problems among specific groups of students? How do attendance issues relate to grades?

*One of the most powerful and central uses of technology at City High, one that integrates educational, communications, and management functions to address a mission critical issue is the WATS list. WATS stands for "**W**alk **A**cross **T**he **S**tage," in other words, graduate. School leaders describe WATS status—to what extent a student is on track to graduate—as "the coin of the realm" at City High, the medium of value and exchange that everyone is focused on. City High's data and communications, and the norms that have been established for using them, allow routine generation of a list of the WATS status of every student in a grade This list then becomes the focus of intensive team planning and the design of student-specific interventions.*

Of course, just having the technology does not guarantee effective use for education, communications, or management and problem-solving. Research on "learning organizations" suggests that knowledge infrastructure must be supported by leadership and culture. At City High, leadership models the use of technology in all core school functions and aims to *"engage every stakeholder in a culture of communication, responsibility, ownership, transparency, and access to and use of data."* Those are norms that go far beyond technology, but they are critical to understanding how technology is used at City High. Wertheimer suggests establishing trust in the technology tools by starting with a focus on communications uses to demonstrate efficiency, reliability, and power. Once electronic communications become routine, other uses flow naturally: *"If you do it right, you shouldn't need a lot of staff development specific to instructional technology integration—give people a tool, get them using it, and they will figure out how to integrate it into what they need to do."*

What are the non-negotiables?

For each of the best practices to be explored in this series of briefs, there are some fundamental assumptions that cannot be compromised if the practice is going to be effective. After eight years of experience, the research and analysis conducted for this brief suggests that the non-negotiables for making 1-to-1 computing work at City High are:

- **Protect the ratio:** Technology use at City High is truly one-to-one. Wertheimer argues that *"anything less than every member of the school with their own machine means it is a presentation tool. Eight machines in a room won't do it. A computer lab won't do it. What if the teacher were the only one with a pen?"*
- **Integration:** Technology use at City High is not optional or an "add-on." Everyone in the school uses it to accomplish their core job/learning functions.
- **Technology serves content:** Technology serves as a powerful and efficient tool for accomplishing teaching and learning goals, not an end in itself.
- **Reliability:** Because City High's laptops are so thoroughly integrated into everything the school does, the technology must be thoroughly supported. City High aims for a 98% reliability rate for both hardware and software.
- **Trust:** City High trusts students to use their laptops responsibly and productively.
- **Comfort with transparency:** Technology makes teaching more transparent and public, opening the virtual classroom door; teachers are comfortable with course content and assignments being visible to their peers, administrators, and parents.

Why does City High do it? Why might other schools want to?

As the first sentence of the school mission statement puts it, *"the mission of City Charter High School, a technology infused public school, is to graduate students who are academically, technologically, personally and socially prepared to succeed in* post-secondary education or training." A teacher puts it more bluntly: *"If we don't get them used to exchanging, using, and managing information this way, we are doing them a disservice. There just aren't that many good jobs anymore where you aren't going to be working this way."* **Laptop use at City High develops not just specific technology skills that may be useful in the workforce but soft skills such as responsibility, ownership,**

and independence. Student ownership of their own laptops provides an incentive for him/her to act responsibly, an important strategic use of technology. Fundamentally, City High's educational program is about research and problem solving, the core skills necessary in college and 21st century jobs, no matter what the specific field. The technology tools the school gives students empower them to take the lead in their own learning.

Just as 1-to-1 computing is central to City High's vision of student learning, it is the core infrastructure that allows staff and students collectively to be a learning organization. Access to instant communications and real-time data enables every member of the community to function more effectively, from an administrator monitoring attendance, to a teacher checking student progress, to a student accessing their latest grades.

How does City High make it work?

Each of these best practice briefs provides practical advice about implementing the strategy. A few of the things City High has found that smoothed the way with 1-to-1 computing include:

IN THEIR OWN WORDS…what do people at City High say are the biggest advantages and downsides of 1-to-1 computing for the way they work?

	Biggest advantages	Biggest downside or risk
Administrators	Keeping your finger on the pulse of what is happening in the building Quick, data-based answers to questions	Information overload
Teachers	Communication with colleagues Flexibility in designing and teaching lessons Ability to build in options for differentiation A more hands-on, research-based curriculum	Classroom management Can be daunting not to have a textbook to fall back on
Students	Staying organized, having access to all work Producing more professional products Communicating with teachers Access to information More choice of topics Temptation for	off-task use

Make it easy for people to buy in: As Wertheimer puts it, *"We knew that we needed to have conscious strategies from the outset to get every constituency bought in and excited about making technology core to their work. Actually, we really only needed to work on staff, parents, and our board. Students don't need any convincing!"* For staff, the key has been investing in a level of support that makes the technology as transparent and dependable as chalk on a blackboard. According to Wertheimer, *"If you guarantee ease of use, make sure it always works and support is always available, people will start to see the efficiencies and believe in the value."* For parents, the hook is in real-time access to their students' assignments, grades and attendance information, as well as enabling more direct communication with teachers. But as with teacher use, the incentive of better information about their child's progress is reinforced with the expectation that they will use it routinely. According to Wertheimer, *"That is their homework, to keep up on their child's progress. This is a tool that empowers them to play an active role."* Technology Manager Ed Crist adds, *"Parents here know to go online to keep informed. It is not just a neat tool like electronic newsletters."* For City High's board, their secure part of the school website provides centralized and organized access to all the information they need and a platform to communicate with each other and school leaders.

Budget realistically and sustainably: Technology is integral to City High's educational and organizational model, so it is part of the general operating budget. Because it is part of the school's core design, school leaders have never relied on grant money to either purchase or maintain technology. Another key to realistic technology budgeting is to make sure the budget covers the total cost of ownership (TCO), including the training, support, repairs, bandwidth, and upgrades needed to keep the laptops functioning at a high level. City High's model expects laptops to keep working for students through the four years of high school and to carry them on to college, so that level of support is built into the budget.

TOTAL COST OF OWNERSHIP —TCO

Infrastructure: *City High has an Ethernet LAN covering approximately 60,000 square feet. High speed wireless network access is available from anywhere in the school. All users have access to network drives, printing in every classroom and the Internet. The school has 10 Megabit Internet access. Phones, Internet and Infrastructure are subsidized through the federal Erate program.*

Purchase: *City High purchases technology for each class as they enter the school through a lease with a local financial institution. The school starts the purchasing process by sending out an RFP to identify the lowest interest rate on a four year lease with a $1 buyout. This is followed by an RFP to purchase the laptops, printers, media devices, projectors, etc. for the incoming 9th grade class, replacement/upgrades for current technology and the annual software licensing for the school. Annual purchases are approximately $400,000. Since a new four year lease is assumed every year, the school has four leases at any given time with an annual debt service of approximately $450,000. This is approximately 4% of the school's total operating budget.*

Smart support: *Laptops are purchased with a four year warranty and accidental complete care. Thus, nearly all repairs are covered by the warranty. City High is a Lenovo and Dell certified warranty site. All repairs are done onsite. The school is compensated by the company. The school has a repair staff that includes a Technology Manager and 7 students. The Technology Manager is an expert in school technology solutions. His salary, benefits and budget (outside of annual purchases) is approximately $125,000.*

Students do the warranty repairs under the manager's guidance and are paid $7/hr. They acquire extraordinary skills which can lead to jobs and college recommendations. The cost of the students is paid for by the warranty rebate. After four years, the laptops are given as a gift to the students upon graduation. Repairing technology in-house guarantees a quick turnaround (between 24-48 hours) and focuses faculty on teaching, not technology support. The total cost of support is approximately 1% of the school's total operating budget.

Give students real professional tools: Rather than giving students the scaled down machines and software targeted at the education market, City High gives them the kind of laptops a professional would expect, with serious hard drive capacity, memory, and speed. As for software, the school used to give them educational or home versions but, says Wertheimer *"we found that baby software yields baby results. The more functionality you give students the more powerfully they use it in their work."* The machines are loaded not with content-specific tutorials but with the productivity and research tools that can take students anywhere.

Specifically, every laptop has a full professional word processer, spreadsheet, and presentation suite (the entire suite of Microsoft and Adobe products), two Internet browsers, a full dictionary/thesaurus/atlas/encyclopedia on their hard drive (so students can still conduct research if the Internet is inaccessible), and an integrated e-mail/calendar/task management system (Edline).

Trust but verify: City High's cultural norm is to inculcate student ownership of all aspects of their learning, including learning tools like technology. When students see the value of the technology to advance purposes they care about, that is all the incentive they need to take care of their machines and use them appropriately. But the school still has back-up systems in place. An Acceptable Use Policy was created and is signed off by parents and students. Discipline procedures are in place for Nuisance, Ethical and Security violations. Off-task computer use and failing to maintain and charge their laptops affects the students "workforce grade," which impact grades and privileges. The school is also constantly improving its filtering capacity.

How do we know it's working?

Each of the best practice briefs in this series provides suggestions about how schools implementing the practice can monitor its effectiveness.

Eight years in, school co-founder Wertheimer describes 1-to-1 computing as *"a resounding success, greater than we predicted. We were scared we would be overwhelmed with repairs and outages, scared teachers would be hesitant, scared not all students would get there. That has not been the case."* City High's experience suggests that monitoring the following kinds of indicators can help schools track and continue to enhance the implementation of one-to-one computing:

- **MOS certifications:** If students are becoming proficient, professional-level users of key productivity tools, they should be able to demonstrate that expertise by passing Microsoft Office Certification exams. These tests not only verify that students have the skills to pursue high-level tasks, they are a credential of immediate value in the marketplace. This is one of the indicators City High tracks on its annual public report card. **The average City High student —including special education students—now graduate with four MOS certifications.**

- **Paper used:** If technology is truly the way a school works and communicates, the paper budget should be low and declining.

- **Logins/use levels:** Most technologies provide built-in ways to monitor use levels. By watching how numbers like website hits and parent logins change over time, City High ensures that tools are being used by intended users.

- **Instructional integration:** Using technology as a learning tool is one of the domains in City High's performance based faculty promotion system and therefore incorporated into classroom observations. To receive an Advanced rating in this area, teachers must
  - *Use technology as a comprehensive teaching and communication tool. Keeps information on Edline up to date by adding, reviewing and changing information daily.*
  - *Incorporate technology into lessons to achieve a higher standard of student learning.*

- **Reliability rate:** If everyone in the organization treats technology as core to their work, they must be able to depend on it. Monitoring problems such as outages, glitches, and needed repairs, along with the turnaround time needed to address them, is critical.

Tradeoffs and challenges (and how City High addresses them)

To give readers of these briefs the benefit of City High's experience with the featured practice, this section attempts to capture some of the pitfalls the school has encountered and the strategies they have used to work through them.

Off-task use: Wertheimer notes, *"Students are no different than office workers—they want to go to social networking sites, they want to do online shopping. And off-task behavior didn't start with technology."* To address the 21st century equivalents of note-passing, City High relies on a combination of filtering software and discipline policies with consequences for the technology itself. Students caught engaging in off-task technology use in class have their laptops wiped clean, which they quickly come to understand makes life difficult. Even with the clear and consequential policies against off-task use and the most sophisticated (and frequently updated) filters, the school has learned a lot about how teachers need to design both their physical classroom layout and their

lesson plans to keep students focused. Ultimately, high tech resources need to be treated like any other classroom resource and integrated into a teacher's overall classroom management strategy. City High has resisted, for example, the implementation of special monitoring software which would allow teachers to see every student's computer desktop on the teacher's screen.

Within the overall framework of school policy, every teacher has to find a system that works for them. An experienced teacher whose students have their laptops open all the time and are expected to take notes on them, comments: *"I know my kids are off task to a certain extent. You need to decide where your line is and what battles you are going to fight. It is in my comfort zone that they will stray a little, multi-task. I've been known to check e-mail during meetings. But the benefits of students having those tools in the classroom far outweigh the drawbacks."* But a newer teacher has the policy *"Unless I tell you to open it, it is closed. I don't let them take notes on the computer. They will be too tempted to look at other things, and I don't think they can really multi-task. That also assumes a level of organization they don't have yet—naming and saving files usefully."*

Technology as icing on the cake: Before coming to City High, many of the school's educators had been in schools and systems that bought technology because it was supposed to be the wave of the future, not because it seemed integral to advancing their mission or vision of student learning. In those situations, teachers saw how acquiring technology for its own sake can lead to the dreaded "PowerPoint syndrome," in which administrators, teachers, and students spend hours making graphically elaborate presentations of content that could have just as well been a simple book report or a memo. Students may come in with this limited view of technology: as one teacher put it, *"even if they are just taking notes in Word, I find they waste a lot of time making documents look pretty with WordArt and animation."* City High set out to avoid this kind of superficial technology use by building substantive use into its instructional and organizational designs AND by making use the daily norm. According to Ed Crist, in his first year as full-time technology director after eight years working for an educational software company: *"I have been in literally hundreds of schools and the norm is for technology to be an extraneous, voluntary tool. I have never seen it, not just so available, but so integral and infused into the culture and curriculum as I have at City High."*

Fact gathering vs. thinking: Many educators have the legitimate concern that giving students access to unlimited, unstructured information will result in work that is more a collection of facts than synthesis and analysis. City High attempted to pre-empt that concern by making research part of the core curriculum. Students are explicitly taught research skills in a double-period course one trimester each year (a total of 130 hours each year and over 500 hours over their high school career). Notes Wertheimer, *"We are the only school in America with four librarians and no library."* This direct instruction in research skills is reinforced by frequent research assignments in all content areas. As students hone their research skills, content teachers structure and scaffold assignments by first putting parameters around appropriate sources. As a science teacher explains: *"I never have them just Google something. The risk is they find websites and write things down verbatim that they don't understand. So I preview the resources and structure the search a little for them."* As students advance towards the ability to do independent work, one of the core school goals, these supports are gradually withdrawn. By the time they are doing their senior projects, they are doing most of their work independently.

Lessons learned

"You can give teenagers a high-powered laptop and let them take it home." Wertheimer recalls that when the school was in the design phase, many people questioned the wisdom of giving expensive computers to teenagers (*"We heard it all—they will break it, steal it, lose it, sell it, trash it, drop it…"*). In eight years, fewer than 10 City High laptops have been lost, and those students reimbursed the school $500 as spelled out in the student handbook. The key to building responsibility is giving students ownership: *"These are not City High laptops, they belong to the students. They need them to do their work. If they leave them at home, or forget to charge the battery—they have to use paper and pencil, which, having become accustomed to working on the computer, they hate. If they take good care of them, they will still be able to use them in college. Knowing these things, students have taken remarkably good care of their machines."* A 9th grader reflects: *"Learning to take care of it is hard, but it is a privilege, a really nice computer. And you learn pretty fast that you need it working to get your work done."*

Support the transition: Faculty know that many 9th graders come in with minimal technology experience, and that most of them need some structure and guidance before they are ready to handle the responsibility of an expensive piece of technology. A current 9th grader comments: *"It was hard to get used to carrying it around everywhere and being careful with it. I had a hard time at first being able to type fast enough to take notes, remembering what button not to push, remembering to save my work to the network drive."* So City High doesn't just hand out the laptops on day 1. As one 12th grader recalls: *"When you first get the laptops, the teachers are very protective of them. They keep them in a closet and only get them out in certain classes to do a specific thing. And the teacher is right behind you! For a few months you don't get to take them home—and then you have to have a workforce grade of C or above. So right away there was a specific computer that was our machine and we could save our work, but we didn't get to carry it around."* Another 12th grader remembered wrestling with temptation to play games during class: *"They have it set up so you can't install games or music, and the site blocker they have is good—you can't get onto Facebook or anything like that. But people find ways to get around that and they share those ways. So in 9th grade they were constantly scanning our hard drives to check what was on there. Now they don't so that so much.* ***You get mature with them. If you don't, you are the one that suffers anyway."***

Teachers also introduce using the computer for daily classwork gradually, scaffolding both technology and organizational skills. In

9th grade, content area teachers keep most of their work paper-based to start, while the technology and research teachers get the students up to speed on laptop basics, from booting up and logging in to manipulating the mouse to having a system for saving work so they will be able to find it again: "We assume nothing. If a student has no keyboarding skills, there is a tutorial. In our 9th grade classes we make sure to have plenty of paraprofessionals and special education teachers in the room as we introduce the habits of working electronically, moving around the room helping students access documents, find the right window, and the like." Over time, as students become more and more comfortable with the machine itself, develop their software skills, and get better at keeping their work organized electronically, classes become more and more paperless. In the later grades, more and more assignments are delivered, completed, and submitted electronically.

New teachers assume they will have these tools. *Because technology is an integral part of City High's mission, most educators seeking jobs at the school are young and/or technology savvy enough to assume this is just how they will work. This is now taken for granted to the point that the school has eliminated the questions they used to have in the interview protocol about educational technology use. And although City High probably attracts a disproportionately tech-savvy applicant pool, their sense is that the generation of teachers coming out of education schools now are ready to use technology more and in more educationally substantive ways than many schools allow or encourage.*

Evolve with the technology: *Along with demonstrating instructional integration, City High teachers are, according to the promotion rubric, expected to "keep up with the latest industry trends in software and hardware." As an example of a pedagogical tool that he couldn't have imagined when the school first opened, Wertheimer cites YouTube (www.youtube.com), which is now heavily used in social studies classes for access to clips of historic events. Similarly, blogging, which didn't exist when the school was designed, has become a powerful way for students and teachers to communicate with each other as they work on major research projects. Teachers across all content areas have been pushed to incorporate the skills that students bring with them, such as the routine use of spreadsheets and data tables. And the technology director tries to follow the lead of the staff, responding to their "I've always wanted to be able to do that" technology ideas by developing applications such as online quizzes and discussion boards.*

What other City High best practices does it connect to?

Ideally, no "best practice" stands alone but is an integral part of a coherent educational approach. See future best practice briefs in this series for information on how 1-to-1 computing at City High connects to other featured best practices including:

Teaching in the big room: City High's Cultural Literacy course thematically integrates topics in English and History, with 52 students around long tables with two teachers. Student laptops enable the differentiation and individual and small group work that make this configuration a powerful forum for student-driven, project-based learning.

Differentiating instruction: City High's population is highly diverse in its academic ability, nearly evenly distributed across all four quartiles on national standardized tests. Students are grouped heterogeneously and all students—including special education students—participate together in a rigorous academic curriculum. The flexibility and access afforded by 1-to-1 computing ensure that every student is appropriately challenged.

Building student academic buy-in: Trusting students with an expensive piece of technology sends the message that this is serious work. The technology then gives students tools to take greater ownership over their own learning by giving students the ability to pursue questions and projects that interest them, not just receive knowledge from a textbook or lecture.

Teaching 21st century skills: From the responsibility required to maintain their laptops to the integrated, individualized projects the tools facilitate, to norms of communication with peers and superiors, student laptops foster skills and habits needed in the modern workplace.

Developing the capacity for independent work: Technology fundamentally puts students in charge of their own learning. Combined with City High's intensive research curriculum, student experiences are carefully scaffolded by grade level to bring students to the point where they can design, manage, and execute serious projects.

Transfer questions

Issue to reflect on in considering adapting this practice in your school…

Is your faculty ready for the transparency of having all of their content online, visible to administrators, colleagues, and parents? What will it take to create that (virtual) open-door culture?

Which areas of your curriculum would benefit most from 1 to-1 computing? Are there areas in which it is harder to see the advantages?

What will 1-to-1 computing mean for student discipline policies?

Once you've got the laptops, where in your operating budget will you find the funds to keep them running at a high rate of reliability?

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