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The Digital Classroom

Jerry W. Brown

Austin Discovery School, Austin, Texas

jerry@jerrywbrown.com

The Digital Classroom

Obviously, the debate on the use, wisdom, and practicality of the Digital Classroom is far from coming to any conclusion or even agreement. The discussion of its pros and cons will extend far into the future, and the individual teacher must address how the introduction of technology is balanced with need for "hands on learning" as discussed in another article in this packet.

Hopefully, the material in this brief workshop will meet the five criteria as outlined by Matheson in the article below. As I write this in February to meet a March 1st deadline, I must admit technology in the classroom is always in the process of changing. With than foreknowledge in mind, I invite you to my web site at www.jerrywbrown.com. Under All Materials, you may then click on The Digital Classroom for additional materials and updates.

Why You Should (And Shouldn't) Use Digital Textbooks
[Edudemic is one of the fastest-growing education technology news sites in the world. The tight-knit community is filled with decision-makers and procurement specialists from school districts around the world.]
By David Matheson on October 27, 2013

The challenge of balancing paperwork, overflowing email inboxes, organized digital files and synchronizing contacts is an ever-present battle in the modern workplace and school. It therefore seems odd that we challenge school age students to do all of the above in addition to organizing exercise books, textbooks and handouts. To then add pressure we provide a measurement of their abilities in a tool as crude as the letters A to E which gets forwarded without their prior knowledge or consultation to their supervisors.

If the digital age is supposed to simplify our lives I suppose it is yet to dawn fully. [Boldface not in original text]

The breaking dawn of digitization in schools leaves us in the twilight between traditional exercise books and fully digital content. This is further exasperated by students carrying both notebook computers and exercise books. While the complete digitization of education seems to be the future there are barriers to this state some of which may even be desirable.

Why Go Digital?

The top level answer is simple… it is the future.

While workplaces across almost all industries continue to integrate technology into their workflow the capacity to operate in that environment is becoming a core skill. It is essential that schools prepare students for the world in which they will enter rather than the world of the past. Through something as comprehensive as digital workbooks students develop those skills which will be the assumed knowledge of the future.

Second tier answers might include:

- Ease of marking
- Transparency between student, teacher and parents when all parties have shared access.
- Prevention of permanent loss through bags being left on busses, etc or even temporary loss “I forgot my books today” or “I packed for the wrong day”.

Arguments Against Digital

Arguing the alternate perspective can be lead through two key points.

High stakes, end of schooling examinations are hand written responses. Through moving to fully digitized models of school work students will be significantly disadvantaged when it comes to these pen and paper examinations which influence career choices significantly.
Writing is not a dead skill. To claim digital as the future and remove all opportunities to practice writing is at best one sided and short sighted. While it is true that we write less today than 30 years ago it is still a significant communication tool that students need to be able to do.

Until high stakes examinations for students are fully online and writing is relegated to the “nice but unnecessary” category students need to build skills in handwriting. Obviously schools are the place where these skills need to be developed.

Why Education?

Concluding with such a deep question may seem a little out of place when reflecting on other questions that seem so operational yet clarity in answers to the big questions makes the answers to little questions easy. It is my claim;

“The task of education is to enable students to more fully engage in their own lives and society.”

Full engagement in life is no small task, nor is preparing young people for this adventure. The challenge here is that when we return to the smaller question of digital or hard copy work both perspectives remain valid. Full engagement in life requires penmanship and touch typing, organization skills physically and digitally as well as user comfort on and offline.

So long as we continue to experience this dichotomy of lives the challenge to and expectation of educational institutions will quite rightly be to prepare students to engage in the online and offline worlds simultaneously.

While I am not happy about it the difficulty of balancing books and files seems like an appropriate reality for some time to come.

Matheson, David. "Why You Should (And Shouldn't) Use Digital Textbooks." *Edudemic connection education and technology*. N.p., 27 Oct 2013. Web. 23 Feb 2014. <http://www.edudemic.com/digital-textbooks-2/>.

5 Features Technology Must Have Before Classroom Use
By David Matheson on April 19, 2013

Hyperboles run rampant when it comes to education technology. The old adage of 'under promise and over deliver' does not appear to be the cultural norm. Almost like a demigod, the education industry seeks the golden bullet that will solve the problem of providing an engaging personalized learning experience for every child and we assume it will have a USB port.

Perhaps reflecting on historical advances in education will shed some light on the task. As one considers the implementation of slates, inkwells in desks, exercise books, chalk (black and green) and white boards as well as overhead projectors it is worth wondering if they received the same degree of expectation that modern tools do.

I recall with great fondness a teacher I worked with in my first appointment, she took great pleasure in explaining her use of some sort of jelly pad device which paint or ink was applied to. As paper was then rolled over the inked jelly the image would transfer to the paper (Google Hektograph for details). This tablet technology must have revolutionized education in much the same way as current tablets. It enabled mass application for a single worksheet and created a shift in pedagogy which continues today through the mass distribution of worksheets. **There can be little argument that in western education circles the jelly pad device and its followers changed the way we do things but has that tool made us better educators and students better learners?** [Boldface not in original text]

Using Technology Without The Art Behind It

In much the same way as my efforts would be painful behind the world's greatest piano, the use of technology as a tool without the art behind it is painful. Similarly violin teachers with the greatest technological advances who lack the art of teaching would not fall far short of my efforts belting out opera.

So it is the buzzword of the last 10 years "Pedagogy" that makes the difference.

The art of teaching supported by technology is quite different to computers teaching and teachers supervising. Recently a group of year 10 students smirked and nodded in agreement when I discussed the inappropriate use of technology for their assessment work. The application of screeching tires as a sound effect when discussing the Great Schism between Eastern and Western Christianity in the 11th Century is hideous as is the use of word art and the animation which sees each letter independently arrive on the screen. Just because it is possible to apply these tools does not make it a good idea. Perhaps the same can be said of teachers applying technology.

Effective Use Of Education Technology

What then is effective and appropriate use of technology?

In my mind, if one or more of the following criteria are not met then we have a problem.

- Technology should make teachers' lives easier.
- Technology should be more accessible for teachers and students (all degrees of academic, physical, mental abilities).
- Technology should improve the learning for students.
- Technology should engage to deepen learning not merely to entertain.
- Technology should be natural.

If the above criteria are not met, then perhaps we are simply shoehorning technology into the classroom for the wrong reasons. In this instance technology distracts, robs learners of time and teachers of opportunity as they hunt for a dongle or try to establish a connection. However, if the above criteria are met, especially when it fits naturally learning becomes more organic, meaningful and effective. Natural use of technology means the teacher and students are so comfortable that it is second nature, natural use of technology means it just fits into the classroom ecosystem without disruption and in fact adds to the beauty and interdependent learning systems that already exist.

Technology in the classroom requires this natural fit which suits the learners and **the artist we call teacher.** [Boldface not in original text]It is no golden bullet, it is not the most important thing in the classroom and is not essential to learners' learning, however, it has the capacity in the same way the jelly pad did to change forever the learning environment. **For this reason we need to support our artists in learning new techniques to complement their teaching talents and not merely expect Picassos by providing the paint.** [Boldface not in the original text]

Matheson, David. "5 Features Technology Must Have Before Classroom Use." *Edudemic connection education and technology*. N.p., 19 Apr 2013. Web. 23 Feb 2014. <http://www.edudemic.com/features-of-education-technology/>.

Bridging the Engagement Gap with Hands-On Teaching February 2013

Overview

The ongoing debate over the achievement gap in American schools has largely overlooked its underlying cause: the engagement gap.

Somewhere between kindergarten and the senior year of high school, many students lose their natural love of learning. Sadly, it is replaced by apathy and disaffection. As students struggle to connect with what they are being taught, they fall further behind and become more disconnected. The engagement gap has an even more profound negative impact on students who are coping with learning challenges.

Fortunately, simple and proven tools exist to close the engagement gap: hands-on activities rekindle a love of learning and connect abstract concepts to the real world -- while achieving desired educational outcomes.

Hands-on instruction has a long and successful legacy in the sciences and math (Basista and Matthews; Bredderman; Haury and Rillero), and shows promise for teaching social studies, history, English and other subject areas. By using hands-on instruction, educators are fostering the 21st century skills that students need to be successful: critical thinking, communication, collaboration, and creativity. Hands-on activities encourage a lifelong love of learning and motivate students to explore and discover new things (Bass, et al.).

Educators need personalized support and specialized resources to get students engaged in learning. Resource Area For Teaching (RAFT) provides Idea Sheets, Activity Kits, and materials that help educators in every subject area and grade level bridge the engagement gap with hands-on teaching.

The Engagement Gap and How it Impacts Achievement

For many years, educators have been keenly aware of the achievement gap affecting students of all ages and grade levels. Performance disparities in the United States not only have a profound impact on individual student development and success, but also on our education system and the future workforce. Studies compiled by the National Center for Educational Statistics ("Achievement Gaps") highlight this epidemic (U.S. Department of Education).

One underlying cause of the achievement gap is frequently overlooked. "Charting the Path from Engagement to Achievement," a report on the annual High School Survey of Student Engagement (HSSSE), "consistently indicated that another gap exists: the engagement gap" (Yazzie-Mintz 17).

While there are several ways to define the engagement gap, its impact is clear: students lose their desire to learn.

Young learners enter kindergarten with a sense of wonder and excitement. Yet, high school students consistently report feeling disconnected from their schools, their teachers, their curriculum, and the knowledge they need to be successful in their lives and careers (Fredricks, et al, 2). Many of the students who participated in HSSSE felt they couldn't connect with what they were being taught or apply that knowledge to the real world (Yazzie-Mintz 13-16).

We know that students need to be engaged to fully appreciate and learn what is being taught. The National Center for Education Evaluation and Regional Assistance has studied the engagement gap and how it impacts student achievement. "Student engagement measures have been shown to correlate positively with achievement and to reduce the drop-out rate. Engaged students are more likely to earn better grades and perform well on standardized tests" (Fredricks, et al, 2). Conversely, engaged students are better able to make an effort to comprehend complex ideas or master difficult skills throughout their education (Fredricks, et al, 2).

Many educators feel they must choose between driving academic performance and nurturing student engagement. But there is good news: it is impossible to do both. Teachers can achieve performance targets while also restoring student engagement.

Hands-on teaching is an extremely effective strategy for increasing performance and depth of knowledge and supports the 21st century skills that target learning and innovation abilities (the 4Cs): communication, creativity, collaboration, and critical thinking (Partnership for 21st Century Skills, 3-4). Well-designed hands-on activities focus learners on the world around them, spark their curiosity, and guide them through engaging experiences—all while achieving expected learning outcomes.

Benefits of Hands-on Teaching

1. Develops critical thinking skills. By investigating the subject matter through hands-on activities, students learn both content and thinking strategies (Hmelo-Silver 236). Hands-on activities support problem-based approaches to learning by focusing on the experience and process of investigating, proposing and creating solutions. As a result, students learn how to gather information and solve problems.

2. Encourages communication and builds language skills. Hands-on activities use real objects to support multiple modes of communication, linking visual learning to what is being said and discussed (Lee, Penfield, and Maerten-Rivera). Hands-on activities enable students to discuss, debate, verbalize and explain processes and concepts while working together. An observation of hands-on learning noted that students demonstrated strong communication tied to working in teams (Bass et al, 10 & 12).

3. Restores focus and sparks engagement. With the right kind of planning and presentation, hands-on teaching can restore focus and spark engagement. An independent observation of teachers using hands-on learning noted that students were enthusiastic and generally stayed on-task during guided hands-on activities (Bass et al, 14).

4. Provides a path to success for disadvantaged students. It has been demonstrated that students who are disadvantaged economically or academically gain the most from activity-based programs (Bredderman 39-41).

Every learner is provided with the same materials and guidance, and can interact with the lessons in the way that builds on their unique level of prior knowledge, past experiences and current abilities.

Hands-on learning inspires all students to meet and exceed high standards for learning and participation, while engaging multiple senses (sight, sound, touch, etc.). The learner can interact with the materials in a way that makes sense for them (e.g., students who tend to learn visually

may connect with the colors and sights while tactile learners can appreciate being able to manipulate objects).

5. Teaches teamwork. Business leaders regularly complain that our education system fails to teach students the 21st-century skills they need for the work world, such as problem-solving, communication, and the ability to work well in teams (Casner-Lotto and Barrington). In the course of doing a hands-on project, students learn to work well with other team members who may have different socioeconomic backgrounds, different learning styles, and different cultures. As a result, students are better prepared to take their place in the business world.

Case in point: Dr. Anna Pollack, a fourth-grade teacher and former pediatrician, has noted that while using hands-on activities in her classroom, the kids discover that one person's weakness is another person's strength. Students are then able to learn from, and appreciate, the skills of their peers while developing their own skill-sets. *"With hands-on learning, kids can be successful wherever they're coming from"*.

6. Improves the teaching experience. The benefits for educators are also numerous. For example, professional development workshops that stress hands-on learning are significantly more successful in improving teacher confidence in math and science instruction (Basista and Mathews). Hands-on activities help teachers cut the time needed for remediation, improve classroom management by unifying students around a common organized activity, and foster a greater interpersonal and supportive emotional connection with students through sharing the process of learning with them (rather than one-way lecturing).

7. Makes teaching and learning fun (again). Finally, hands-on teaching is fun. Not just for students but for educators who are eager to go beyond merely presenting information and administering tests. Larry Laskowski, a middle school instructor, emphasizes this fact: *"Students want*

to have more fun. If it's fun, the experience stays with you." Dr. Pollack shares Laskowski's sentiment:

"You don't hear a lot of laughter without hands-on. I love this about hands-on. (The students) laugh.

They enjoy learning."

<u>Maintaining Positive Results</u>

Research shows that once educators incorporate hands-on teaching, they are more likely to continue using hands-on learning in their classrooms.

In a 2011 survey of RAFT members, 89% of teachers report that they are doing more hands-on activities in their classrooms and offering a wider variety of hands-on activities. 99% report their

students are more engaged in learning and retain knowledge longer as a result of their hands-on experience.

In general, educators using hands-on activities reported an increase in student engagement, knowledge retention, and learner independence (Haury and Rillero). Teachers who see these results— more engagement and excitement to learn—want to keep that spark alive in their students.

Laskowski finds that as his students' enthusiasm and excitement builds, they are motivated to share what they have made or worked on with family and friends. Laskowski purposefully selects hands-on activities that let students take their materials home. *"Kids who want something more still have access to those materials,"* he shares*. "They can still work on things at home, if they like. The option is there.*" Since discovering RAFT, Laskowski finds that he can do more with a limited budget and let the students take their projects home, knowing it will continue to make an impact and keep students engaged.

Conclusion

From study after national study, to the individual experiences of local teachers, we know that hands-on teaching has the power to level the learning field and restore motivation while developing the 21st century skills children need to become successful lifelong learners.

Hands-on teaching rekindles the sense of wonder and love of learning that young children inherently bring to the classroom. When more teachers are equipped to close the engagement gap—restoring motivation, connection, and the desire to learn—student performance will reach new heights and the achievement gap will become a thing of the past.

Bridging the engagement gap starts in individual classrooms, with instructors who are willing and able to increase student engagement and restore the love of learning—instructors like Laskowski and Pollack who are willing to try something different, giving their students the opportunities and tools they need to learn how to learn—by investigating, by questioning, by fueling their curiosity and need to know. Teacher and RAFT member Larry Laskowski said it best:

"Hands-on teaching levels the learning field. A level field doesn't guarantee that everyone plays. But I think anything you can do to give everyone a chance to succeed is worth doing."

RAFT overcomes the barriers to hands-on education by developing innovative Idea Sheets, and prepackaged Activity Kits focused on important concepts in science, technology, engineering and math (STEM) as well as reading and art. RAFT also helps educators create their own hands-on activities and gain the knowledge and confidence to use them.

You can transform the lives of students starting with one classroom, one hands-on activity.

To learn more about closing the engagement gap and jump-starting education in America, visit RAFT (Resource Area For Teaching) at [www.raft.net.](http://www.raft.net)

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What's Missing From The New Digital Classroom?

Technology is just a tool; it's how we apply it that will determine the future of education.

As part of my research at Forrester, I've spent a lot of time getting to know companies developing technology solutions for K-12 and higher education. Massive Open Online Courses (MOOCs) like Coursera and Udancity give students around the world access to high-quality courses for free or at a fraction of the cost of a traditional university. Platforms like Inkling, Kno, and CourseSmart make distributing, purchasing, and consuming digital textbooks more convenient and engaging. Supplemental content sources like Khan Academy and TenMarks give students resources to learn at their own pace.

It's worth thinking seriously about how these solutions will change the nature of education. Many of the changes are positive. We expand access to education across the globe. At the same time we increase scale, we also enable more individualized, self-paced learning, presumably at a reduced cost. For example, millions of students can dissect a cow's eye in a virtual biology lab without the incremental cost of buying more cow's eyes or scalpels or formaldehyde - and they could do it again if they miss something the first time. Through analytics embedded in texts, apps, and diagnostic tools, teachers will get real-time feedback and can make more-informed decisions about how to teach.

Education ≠ Screen Time

But they also make me think that the future of education is a lot of screen time.

We all love screens, but physiologically, they're not that good for us. They come with tradeoffs of eye strain, bad posture and sleep interference; they're so immersive that it takes us longer than we think to recover and engage with the physical world, even to the detriment of our and others' health and safety.

Marshall McLuhan is long passé, but it's worth considering that if "the medium is the message," the message we are sending to students is that engaging with content and people via screens is a more valuable use of their time than engaging with the physical world and the people in their physical presence. (We also embrace that message as information workers, but that's a topic for another day.) K-

12 students are in a physical school building for 7 hours or more per day, and college students are on campus together in physical space for most of the year. That may not be the case forever, but today, those are the physical realities of education, and they deserve attention, too.

We need to complement the digital tools we're developing by strengthening students':

*** Social relationships.** Helping answer questions in a MOOC forum is great, but it's not the sum total of what students need to learn about how to relate to peers and teachers. The flipped classroom concept is one solution - the idea is that students absorb the lecture or course materials online outside of class, and when they arrive to the physical classroom their time is used for discussion or group activities.

*** Physical activity.** A major downside of screen time is sedentariness, and the research is pretty clear that sitting kills. Intriguingly, wearable devices could actually play a role in increasing students' activity levels - and could be applied to cross-disciplinary lessons, not just gym class. For example, wearable activity trackers could be used to integrate physical education and math curricula (students move and then analyze the data); add GPS and you get a geography lesson; add heartrate tracking and you move into biology territory.

*** Hands-on experimentation.** Many research studies show that hands-on experimentation helps students learn better. I've experienced this myself recently as a student in a workshop hosted by the software company Intuit, where the company shared its design-thinking approach to innovation with customers and partners - and the participants tested out the methodology with our own hands-on experiments. A new startup high school in San Mateo, Calif., wants to apply this kind of design thinking, influenced by Stanford's d. school, to its own curriculum.

Technology Is Only Part Of The Education Equation

Technology is just a tool; it's how we apply it that will determine the future of education. We need to pay attention to what problems we *aren't* solving with the current crop of technology innovations - and what gaps these solutions create - so that we can figure out where to innovate next. In particular, we need to complement these tools with innovation in how we use the physical space of learning environments, and how we engage with the people in them.

Organizations like The Bill & Melinda Gates Foundation, venture capital firms like Andreessen Horowitz, technology companies like Apple and Intel, numerous software startups, our government, universities, every teacher and every parent actively invest in the future of education. Increasing access, improving outcomes and cutting costs absolutely deserve investment - but so too does the physical experience of learning.

Epps, Sarah Rotman. "What's Missing From The New Digital Classroom?." *Readwrite*. Say Media, 19 Feb 2013. Web. 22 Feb. 2014. <http://readwrite.com/2013/02/19/whats-missing-from-the-new-digital-classroom

Does the Digital Classroom Enfeeble the Mind?

Adding to an already rich life, my father decided in middle age to become an elementary-school teacher in a working-class neighborhood in New Mexico. To this day, people who run grocery stores and work on construction sites, and who are now in late middle age themselves, come out when I'm visiting to tell me how Mr. Lanier changed their lives. Go up to any adult with a good life, no matter what his or her station, and ask if a teacher made a difference, and you'll always see a face light up. The human element, a magical connection, is at the heart of successful education, and you can't bottle it.

My father would have been unable to "teach to the test." He once complained about errors in a sixth-grade math textbook, so he had the class learn math by designing a spaceship. My father would have been spat out by today's test-driven educational regime.

But this is not the whole story. Probe one of those illuminated faces further, and you can also usually elicit memories of a particularly bad teacher. It's a romantic notion, the magic of teaching, but magic always has a dark side. Trusting teachers too much also has its perils. For every good teacher who is too creative to survive in the era of "no child left behind," there's probably another tenacious, horrid teacher who might be dethroned only because of unquestionably bad outcomes on objective tests.

So we face a quandary: How do we use the technologies of computation, statistics and networking to shed light — without killing the magic? This is more than a practical question. It goes to the heart of what we are after as humans.

A career in computer science makes you see the world in its terms. You start to see money as a form of information display instead of as a store of value. Money flows are the computational output of a lot of people planning, promising, evaluating, hedging and scheming, and those behaviors start to look like a set of algorithms. You start to see the weather as a computer processing bits tweaked by the sun, and gravity as a cosmic calculation that keeps events in time and space consistent.

This way of seeing is becoming ever more common as people have experiences with computers. While it has its glorious moments, the computational perspective can at times be uniquely unromantic.

Nothing kills music for me as much as having some algorithm calculate what music I will want to hear. That seems to miss the whole point. Inventing your musical taste is the point, isn't it? Bringing computers into the middle of that is like paying someone to program a robot to have sex on your behalf so you don't have to.

And yet it seems we benefit from shining an objectifying digital light to disinfect our funky, lying selves once in a while. It's heartless to have music chosen by digital algorithms. But at least there are fewer people held hostage to the tastes of bad radio D.J.'s than there once were. The trick is being ambidextrous, holding one hand to the heart while counting on the digits of the other.

How can you be ambidextrous in the matter of technology and education? Education — in the broadest sense — does what genes can't do. It forever filters and bequeaths memories, ideas, identities, cultures and technologies. Humans compute and transfer nongenetic information between generations, creating a longitudinal intelligence that is unlike anything else on Earth. The data links that hold the structure together in time swell rhythmically to the frequency of human regeneration. This is education.

Now we have information machines. The future of education in the digital age will be determined by our judgment of which aspects of the information we pass between generations can be represented in computers at all. If we try to represent something digitally when we actually can't, we kill the romance and make some aspect of the human condition newly bland and absurd. If we romanticize information that shouldn't be shielded from harsh calculations, we'll suffer bad teachers and D.J.'s and their wares.

Right now, many of these decisions are being made by the geeks of Silicon Valley, who run a lot of things that other people pretend to run. The crucial choice of which intergenerational information is to be treated as computational grist is usually not made by educators or curriculum developers but by young engineers.

The results are mixed. There is a youthful energy applied to some questions, like how to rate teachers. It would be wonderful if computation remained forever associated with youth. Maybe that will happen, and in a hundred years, or a thousand, algorithms and databases will conjure spring flings and all-night parties.

The geeks often get things wrong, however. In some cases, simple design solutions can fix problems that geeks have created. An example is concern over the effects of constant mental multitasking. If this problem turns out to be serious in the long term, it can probably be addressed by small changes to digital designs. For instance, maybe it will cost a penny every time you look at your Facebook wall in the future, so you'll have to actually be aware of when you do it.

The deeper concern, for me, is the philosophy conveyed by a technological design. Some of the top digital designs of the moment, both in school and in the rest of life, embed the underlying message that we understand the brain and its workings. That is false. We don't know how information is represented in the brain. We don't know how reason is accomplished by neurons. There are some vaguely cool ideas floating around, and we might know a lot more about these things any moment now, but at this moment, we don't.

You could spend all day reading literature about educational technology without being reminded that this frontier of ignorance lies before us. We are tempted by the demons of commercial and professional ambition to pretend we know more than we do. This hypnotic idea of omniscience could kill the magic of teaching, because of the intimacy with which we let computers guide our brains.

> At school, standardized testing rules. Outside school, something similar happens. Students spend a lot of time acting as trivialized relays in giant schemes designed for the purposes of advertising and other revenue- minded manipulations. They are prompted to create databases about themselves and then trust algorithms to assemble streams of songs and movies and stories for their consumption.

We see the embedded philosophy bloom when students assemble papers as mash-ups from online snippets instead of thinking and composing on a blank piece of screen. What is wrong with this is not that students are any lazier now or learning less. (It is probably even true, I admit reluctantly, that in the presence of the ambient Internet, maybe it is not so important anymore to hold an archive of certain kinds of academic trivia in your head.)

The problem is that students could come to conceive of themselves as relays in a transpersonal digital structure. Their job is then to copy and transfer data around, to be a source of statistics, whether to be processed by tests at school or by advertising schemes elsewhere.

What is really lost when this happens is the self-invention of a human brain. If students don't learn to think, then no amount of access to information will do them any good.

I am a technologist, and so my first impulse might be to try to fix this problem with better technology. But if we ask what thinking is, so that we can then ask how to foster it, we encounter an astonishing and terrifying answer: We don't know.

The artifacts of our past accomplishments can become so engrossing in digital form that it can be harder to notice all we don't know and all we haven't done. While technology has generally been the engine that propels us into unknowable changes, it might now lull us into hypnotic complacency.

> To the degree that education is about the transfer of the known between generations, it can be digitized, analyzed, optimized and bottled or posted on Twitter. To the degree that education is about the self- invention of the human race, the gargantuan process of steering billions of brains into unforeseeable states and configurations in the future, it can continue only if each brain learns to invent itself. And that is beyond computation because it is beyond our comprehension. Learning at its truest is a leap into the unknown.

Roughly speaking, there are two ways to use computers in the classroom. You can have them measure and represent the students and the teachers, or you can have the class build a virtual spaceship. Right now the first way is ubiquitous, but the virtual spaceships are being built only by tenacious oddballs in unusual circumstances. More spaceships, please.

> *Jaron Lanier, a partner architect at Microsoft Research and the innovator in residence at the Annenberg School at the University of Southern California, is the author, most recently, of "You Are Not a Gadget."*

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Brilliance in a Box
What do the best classrooms in the world look like?

By Amanda Ripley (author of ***The Smartest Kids in the World--and How They Got That Way***)

Imagine if we designed the 21st-century American classroom to be a place where our kids could learn to think, calculate, and invent as well as the students in the top-performing countries around the world.

What would those spaces look like? Would students plug into mini-MRI machines to record the real-time development of their brains' executive functions? Would teachers be Nobel Prize winners, broadcasting through screens installed in the foreheads of robots that don't have tenure?

To find out, we don't have to travel through time. We could just travel through space. At the moment, there are thousands of schools around the world that work better than our own. They don't have many things in common. But they do seem to share a surprising aesthetic.

Classrooms in countries with the highest-performing students contain very little tech wizardry, generally speaking. They look, in fact, a lot like American ones—circa 1989 or 1959. Children sit at rows of desks, staring up at a teacher who stands in front of a well-worn chalkboard.

"In most of the highest-performing systems, technology is remarkably absent from classrooms," says Andreas Schleicher, a veteran education analyst for the Organization for Economic Cooperation and Development who spends much of his time visiting schools around the world to find out what they are doing right (or wrong). "I have no explanation why that is the case, but it does seem that those systems place their efforts primarily on pedagogical practice rather than digital gadgets."

And yet, when politicians and bureaucrats imagine the classroom of the future, they often talk about a schoolhouse that looks like an Apple store, a utopia studded with computers, bathed in Wi-Fi, and wallpapered with interactive whiteboards (essentially giant touch screens used in place of chalkboards in more and more classrooms nationwide). "In the 21st century," Education Secretary Arne Duncan said in a speech in Washington, D.C., this March, "schools can't be throwbacks to the state of education 50, 20, or even 10 years ago. … We must make the on-demand, personalized tech applications that are part of students' daily lives a more strategic part of their academic lives."

But the most innovative schools around the world do not tend to be the ones with the most innovative technology inside them. To American exchange students, the difference can be disorienting. Kristin De Jesus is currently attending a public school in South Korea through an international study program called Youth for Understanding. De Jesus came to Korea, which consistently ranks at the top of the world in international exams, from a high school outside of San Diego, where she would be a junior.

In her Korean school, near Seoul, her classmates have iPod touches and iPhones and play Nintendo, just like her classmates in America. But the classroom itself is austere. "In California, we use white boards, while in Korea they use chalkboards," she says. "There is a dirt field outside. We have a projector, that's about it." Back home, teachers would hand out Mac laptops for kids to work on in class. But in Korea, the only computers are older PCs, and they remain in the computer lab, which is used only once a week for computer class.

So how to explain that these old-fashioned classrooms tend to crank out kids who possess far more of the math and science skills valued by modern-day employers? For one thing, while the American school day can be as short as six hours, Korean kids attend school about eight or nine hours a day—and then many of them continue studying alone or with tutors until late into the night. Korean parents also put enormous pressure on kids to study. "The American system is a lot easier," De Jesus says. "When I was in California, I barely ever studied and did pretty well in my classes."

School does not have to be grueling to be good. In Finland, the schools have almost nothing in common with the pressure-cooker classrooms of Korea. Finnish students start going to school a year later than American kids, and they do less homework on average. Standardized tests are rare. And yet, in 2006, Finnish teenagers ranked first in math and science among 30 OECD countries. (The United States ranked 25th in math and 21st in science)

Around the world, countries have found a variety of ways to make schools work—even for poor kids or immigrant kids. They spend less money per pupil than we do but distribute it more efficiently and more equitably. More importantly perhaps, school systems in Singapore, Finland, and Korea recruit 100 percent of their teachers from the top one-third of their academic cohort, according to a 2010 McKinsey & Co. report, "Closing the Talent Gap". In the United States, about 23 percent of new teachers—and only 14 percent in high-poverty schools—come from the top one-third. "It is a remarkably large difference in approach, and in results," the report concludes.

Even within the United States, the best schools are not the most tricked-out ones. In Southeast D.C., Lisa Suben teaches fifth-grade math at KIPP DC: AIM Academy, one of 99 Knowledge Is Power Program charter schools around the country. When her students come into her classroom, they perform about two years behind, on average. By the time Suben has had nine months with them, they are mastering grade-level work.

Watching Suben teach on a recent October afternoon, I initially forgot to note whether her classroom contained any modern-day technology. Her class of 31 African-American students sat spellbound as she led them in call-and-response chants to practice their multiplication tables, pasted stickers on their foreheads for getting questions right, and timed how long it took them to get all their homework into a pile in the first row (18 seconds).

Finally, I remembered why I was there. I counted four computers in the back of the room, an ink-jet printer, and an overhead projector that looked to be at least 15 years old. Later, I asked Suben, who has been teaching for eight years, what the perfect classroom would look like. "If I were designing my ideal classroom, there'd be another body teaching. Or there'd be 36 hours in the day instead of 24."

Suben, like most great teachers, is in a hurry. She said computers can be useful, but mostly because they save her time—by assessing what her kids know more efficiently than she can. Three times a year, her students take computer-adaptive tests, which get harder as the student goes along. Suben gets the results instantly, which means she can see how a student is doing compared with the other kids in her class, the school, and around the country. "It might say, 'You know how to round to the hundreds, but you don't know how to round to the thousands?' That's, for me, an aha moment."

Ask middle-school teachers what they would like to change about classroom design, and they suggest a bathroom for the kids. When I ask Suben which gadget she would bring with her if she had to teach on a desert island, she chooses the overhead projector, without hesitation. "I wouldn't be able to give up the

overhead, because then I'd have to turn my back to the class," she said. The oldest technology in the room is the one that helps her the most with a fundamental human skill—presenting material while staying connected to every student in the room, watching who is getting it and who is not, without having to turn to write on a chalkboard.

The KIPP charter schools have proved to be among the most effective schools in the country. But their classrooms would be very familiar to anyone who went to school before there was such a thing as charters. KIPP DC founder and former teacher Susan Schaeffler says she could theoretically put a fancy interactive white board in every classroom in Suben's school for about $300,000. But, she adds, only about half the teachers would use them. "I'd rather pay Lisa Suben more to stay forever."

Ripley, Amanda. "Brilliance in a Box." . Slate, 20 Oct 2010. Web. 22 Feb 2014. <http://www.slate.com/articles/news_and_politics/the_hive/2010/10/brilliance_in_a_box.html>.

David Pogue -- 10 top time-saving tech tips

Scrolling: Scroll down a page by using the space bar. Scroll back up by holding the shift key and the space bar at the same time.

FIlling Out Forms: You can toggle between boxes on online forms using the Tab key. When there's a pop-up menu for you state or country, type the first initial repeatedly.

Changing Text Size: Control + increases the size of your text. Control - decreases the size of your text. (Command+ on a Mac, maybe)

Auto Punctuate: Two taps of the space bar on your phone earns you a period – and the bonus of an automatically capitalized next letter.

Redial: Simply press the call button on your phone to redial the last number you called.

Voicemail Shortcuts: We all know how to leave a voicemail, so why do cell carriers give you a list of instructions before you can just hear the stinking beep and leave the message? There are keystrokes that allow you to bypass the instructions, though they vary for each carrier. Verizon:* AT&T, T-Mobile:#

Google Knows All: Look up the definition of any word with Google by typing “define” followed with the word you want to understand in the Google search bar. Flight tracking. Unit conversion. You can use Google to do math for you. Just type the equation, like 23*7+15/3=, and hit Enter. Oh, yeah: on the computer, * means “times” and / means “divided by.” When you’re searching for something on the Web using, say, Google, put quotes around phrases that must be searched together. For example, if you put quotes around “electric curtains,” Google won’t waste your time finding one set of Web pages containing the word “electric” and another set containing the word “curtains.”

Highlighting: Double click any word to highlight it. If you need to delete that word, just start typing, and it will be magically replaced! Double-click/drag to select in one-word chunks. Triple-click to highlight a paragraph.

Stand Alone Cameras: For the folks who use cameras that aren't just a part of their smartphone, you can avoid shutter lag by half pressing down the button of your camera about halfway before you take the picture.

Giving A Presentation?: Black out a slide by pressing B, or white it out by pressing W.

Plus One More: You can hide all windows, revealing only what's on the computer desktop, with one keystroke: hit the Windows key and "D" simultaneously in Windows, or press F11 on Macs (on recent Mac laptops, Command+F3; Command is the key with the cloverleaf logo). That's great when you want examine or delete something you've just downloaded to the desktop, for example. Press the keystroke again to return to what you were doing.