

There are no technology shortcuts to good education.

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## ICT in Schools

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# There Are No Technology Shortcuts to Good Education

KENTARO TOYAMA

There are no technology shortcuts to good education. For primary and secondary schools that are underperforming or limited in resources, efforts to improve education should focus exclusively on better teachers and stronger administrations. Information technologies, if at all, should be targeted for certain, specific uses or limited to well-funded schools where the fundamentals are not in question.

(Caveat: Because this article was written for an audience most interested in government-funded primary and secondary education in developing countries, words like “wealthy,” “average,” and “typical” should be read with that context in mind. But, the conclusions are relevant for a broad class of primary and secondary schools in developed countries, as well.)



To back these assertions, I'll draw on four different lines of evidence.

1. The history of electronic technologies in schools is fraught with failures.
2. Computers are no exception, and rigorous studies show that it is incredibly diff

positive educational impact with computers. Technology at best only amplifies the pedagogical capacity of educational systems; it can make good schools better, but bad schools worse.

3. Technology has a huge opportunity cost in the form of more effective non-tech interventions.
4. Many good school systems excel without much technology.

The inescapable conclusion is that significant investments in computers, netbooks, smartphones, and other electronic gadgets in education are neither necessary nor warranted for most school systems. In particular, the attempt to use technology to fix underperforming classrooms (or to replace non-existent ones) is futile. At all but wealthy, well-run schools, one-to-one computer programs cannot be recommended in good conscience.

All of the evidence stands on its own, but I will tie them together with a single thread that explains why technology is unable to substitute for good teaching: Quality primary and secondary education is a multi-year commitment whose single bottleneck is the student's *motivation* to climb an intellectual Everest. Though children are naturally curious, they nevertheless require ongoing guidance and encouragement to persevere on their ascent. Caring supervision from human teachers, parents, and mentors is the only way of generating motivation for the hours of a school day, to say nothing of eight to twelve years.

While computers appear to engage students (which is exactly their appeal), the end result swings between uselessly fleeting at best and addictively distracting at worst. No technology today or in the foreseeable future can provide the tailored attention, encouragement, inspiration, or even the occasional scolding for students that dedicated adults can. Attempts to use technology as a stand-in for capable instruction are bound to fail.

With respect to sustaining directed motivation, even the much-maligned rote-focused sergeant disciplinarian is superior to any electronic multimedia carnival. (In an [October 2011 ETD article](#), James BonTempo also highlighted the importance of motivation. But BonTempo suggested that we should seek technologies that motivate both teachers and students, I believe today's technology is not up to the task. [Note: The author retracted that statement and agrees with BonTempo, as his articles actually suggest that even the best technology is possible if neither teachers nor students are motivated to begin with.])



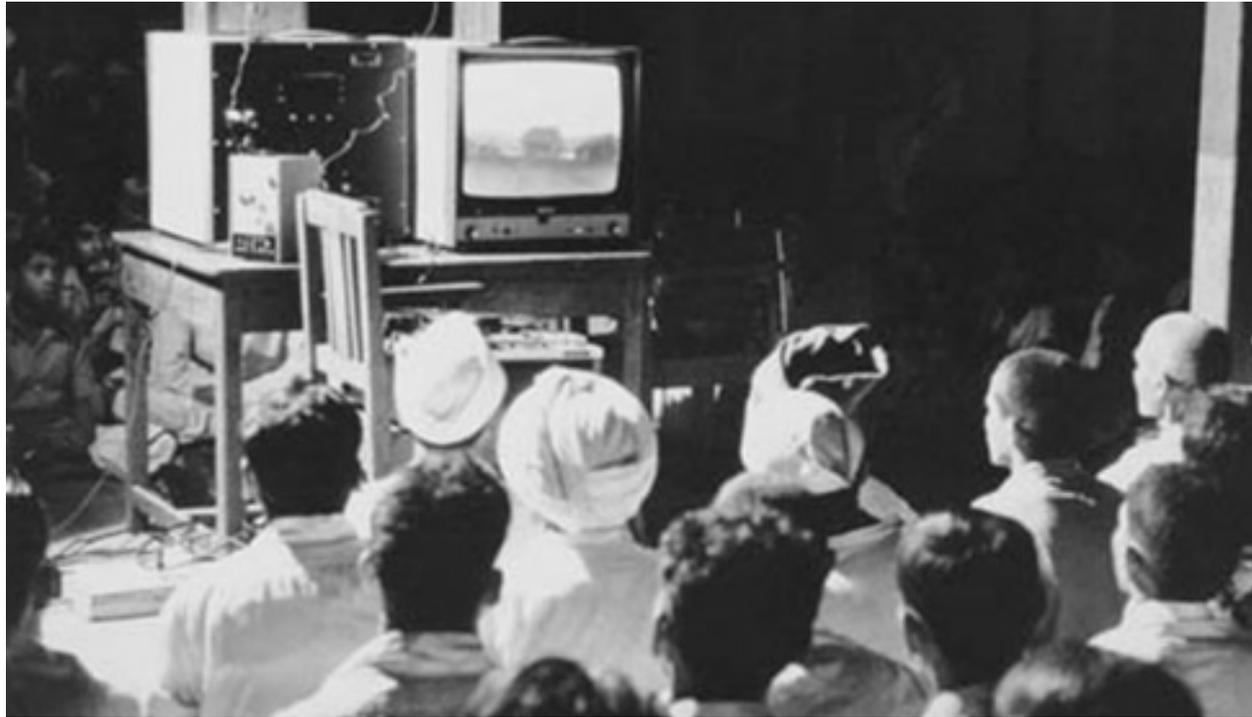
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## The Repetitive Cycle of Technology



For anyone concerned with high-tech in schools, two books are required reading on technology and education. The first is Larry Cuban's [Teachers and Machines: The Use of Technology Since 1920](#), which overviews the history of films, radio, television, and computers in American education up to the early 1980s. The second is Todd Oppenheimer's [The Flickering Mind: Saving Education from the False Promise of Technology](#). Oppenheimer also focuses primarily on US education, but updates and expands on Cuban's findings on computers in schools through the early 2000s. Both authors consider the record of schools and find it wanting. They reveal that while technologies can have positive impact in restricted instances, successes pale in comparison to failures overall. By this past history, we seem condemned to repeat it over and over and over.

One point that both authors make is that there is a repetitive cycle of technology in education that goes through hype, investment, poor integration, and lack of educational outcomes. The cycle keeps spinning only because each new technology reinitiates the cycle. In 1879, Edison claimed that movies would "revolutionize our educational system." In 1945, Levenson, a Cleveland radio station director, suggested that portable radios in classrooms should be "integrated into school life" alongside blackboards. In the 1960s, government leaders John F. Kennedy and Lyndon Johnson invested in classroom TV. In an irrational line of reasoning that is symptomatic of technology in education, Johnson went from a view of "Unhappily, the world has only a fraction of the teachers it needs," to a non-solution to the challenge "through educational television."

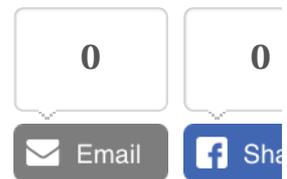
The hubris and failures of technology projects are detailed by Cuban and Oppenheimer. With hindsight available to all of us, we know that none of these technologies has lived up to their promises. If anything, we have become wary of their educational power. For one thing, on the one hand, television excels as a medium for delivering information. Seduced by its clarity and vividness of television teaching were to be used to help the schools develop a new educational pattern?" He was thinking, in particular, of mass media's potential to revolutionize education for developing countries.

The transformation never occurred, probably because as motivational as television falls far short of generating the motivation required for education. For every person prey to Madison Avenue's latest advertisement, hundreds of others just ignore it on channel – if that's true of the most persuasive television commercials, why should television be able to regularly sustain the motivation (and not just the attention) of distracted children to do the cognitive push-ups that education demands?

In the meanwhile, many of us have come to sense television's shortcomings. Educators restrict their children's time in front of the TV, and many households ban television. At its best, television is considered a cheap babysitter to hold a child's attention when attention is scarce; at its worst, television caters to our weakest impulses, glamorizes materialism, desensitizes us to violence, and lulls us into a zombie-like trance. As a result, people today would laugh at a school system based on watching broadcast television, however educational. Yet, that was exactly the idea behind an experiment in America in the mid-1960s, where the "education" of 80% of students was based on watching television telecasts. The program was dismantled several years later as teachers, administrators, and even students expressed dissatisfaction with the students' academic performance.

### Computers: The Latest Technology Cycle

Today, computers and mobile phones are the shiny new technologies, and they offer an even more seductive promise. One argument goes that it was the passiveness of older technologies that was the problem, so today's interactive digital technologies are the perfect solution.



Patrick Suppes, a pioneer in computer-aided learning suggested in 1966 that computers should "adapt mechanical teaching routines to the needs and the past performance of the individual student." But, neither interactivity nor adaptive capacity are sufficient – the key challenge in education remains the long-term, directed motivation of the student – something that technology today can deliver on its own, but which good teachers deliver regularly.

Of course, computers *are* different from radio or television, so if they are able to prove themselves in education, we should use them. Alas, the research on computers in education consistently arrives at a single conclusion, which at its most optimistic could be stated as follows:

Computers can help good schools do some things better, but they do nothing positive for underperforming schools. This means, very specifically, that efforts to fix broken schools with technology or to substitute for missing teachers with technology invariably fail.

Mark Warschauer, the foremost authority on technology in American classrooms, spent countless hours studying computer projects. He writes of underperforming US schools that "the provision of computers and Internet connections in low-[income] schools, in and of itself, does not address the serious educational challenges faced by these schools. To the extent that the emphasis on provision of equipment draws attention away from other important educational interventions, such an emphasis can in fact be counterproductive."

And, as for technology's capacity to even level the playing field of education, he says, "the introduction of information and communication technologies in [...] schools serves to exacerbate existing forms of inequality." This is a specific instance of a [broader thesis](#) I argued

technology's role as an amplifier of existing institutional forces.

In the international arena, and using experimental methodology, economists con findings. In rigorous large-scale studies in both India and Colombia, Leigh Linden University found that while PCs can supplement good instruction, PCs are a poor time with teachers. Furthermore, large-scale computer roll-outs in these countries significant educational outcomes compared against students who didn't receive co suggests that one problem is that teachers don't successfully incorporate compute curricula. (Nor are teachers to blame – technology programs routinely fail to accou teachers' needs.)

Ana Santiago and her colleagues at the Inter-American Development Bank find a s for a Peruvian One Laptop Per Child program. Three months after a large-scale roll despite teacher, parent, and student excitement around the technology, students nothing in academic achievement. Santiago also notes that even during the initial months, the novelty factor of the laptops appears to wane, with each week seeing devices.

None of these results run counter to the few research studies that show how comp benefit education in limited ways. But, all positive instances of computers in scho strong institutional foundations that are exactly what is deficient where technolog to save the day. Without the institutional base, technology's impact is zero or nega should immediately cause anyone hoping to fix an underperforming classroom to technology as any part of the "solution."

As Wayan Vota notes in a [May 2009 ETD article](#), unless the institutional foundation and administrators is built and funded properly, technology is pointless. With the motivation, it's easy to understand why. Bad schools are unable to direct student r towards educational goals. Since technology itself requires proper motivation for i accrue, any school that can't direct student motivation capably will fail to do so wi technology, as well (or worse, allow technology to distract students).

### **The Cost Implications of Technology Investments**



Educators often parrot that “technology is not a panacea,” by which they mean either

1. that technology doesn't cure all educational ills or
2. that technology alone is insufficient as a solution.

Though these acknowledgments are far better than a blind faith in technology, they reveal the hidden, unjustified expectations of technology. The first interpretation suggests that technology cures *some* maladies in education. But, this is exactly what doesn't happen – the evidence shows that technology does not cure unhealthy educational systems; at best, it augments healthy ones. The second belief is more dangerous because it is factually misleading for policy. It implies that technology can be a good solution as long as other investments are also made; what it leaves out is that if alternate investments of the same magnitude were made to support education directly (and not indirectly to support technology), the educational results could be far greater.

The issues here are cost-effectiveness and opportunity cost. Of course, if the net benefit of a technology solution is zero or negative, it's pointless to implement it however low the cost. But because many educators are tempted by technology's supposed ability to lower costs, it is worthwhile to consider actual costs of well-implemented technology.

The most common error in computing costs is to assume that hardware and software are the dominant costs of technology. In reality, the total cost of ownership (TCO) for information technology is comfortably several times the cost of hardware, with a range of 5-10x as a rule of thumb. Beyond hardware, necessary costs include costs of distribution, maintenance, power infrastructure, teacher training, repair and replacement, and curriculum integration. In a [May 2010 ETD article](#), Sam Carlson, who unlike me believes in technology for education, nevertheless highlights just how much of an investment teacher training requires. Other costs often include connectivity, software development, content production, and support. One [analysis by Vital Wave Consulting](#) shows the TCO of an ultra-low-cost IT program in the \$2000-3000 range for developing country schools. A similar [analysis by OLPCnews](#) shows a TCO over five years for OLPC (the very optimistic advertised lifespan of an OLPC laptop is 3 years) at [an OLPC implementation in Nepal](#) (cf., OLPC's current cost of \$188). These figures show that so a one-to-one laptop program would incur these costs per-student.

Though figures like the ones above show otherwise, technology providers eagerly feed into common technology-cost misconceptions. Nicholas Negroponte, founder of OLPC, has been touting a \$1-per-week total cost for his laptops. But, a dollar a week doesn't even pay for the device over three years, which many observers agree is a reasonable estimate of its useful life. It appears his accounting skills are not on par with his salesmanship. Even at \$1 a week, the price is out of proportion for many developing-country budgets. The government of India, for example, spends no more than \$200 per student per year for primary and secondary education, and most of that expense goes to teacher salaries. And, while literacy rates in India are high, they remain around 60%. Many other developing countries spend even less, with very low literacy rates. Does it make sense to take a quarter or more of a struggling school system's budget to invest in technologies that haven't even proven themselves?

With respect to costs, it's worth keeping in mind the opportunity cost of technology. For example, research by economists Ted Miguel, Michael Kremer, and others has consistently shown the value of 50-cent deworming pills for education. The pills free children from illness and eliminate one of the dominant reasons for student absenteeism in many developing countries. At a cost of only \$3.50 per student (over several years), countries with high rates of parasites can effectively add the equivalent of an extra year of schooling. Similar benefits have been had from provision of midday meals, iron supplements, and teaching assistants, all at a much lower cost than that of computing technology.

As for better teaching, educator Doug Lemov enumerates a series of instructional techniques in his book [Teach Like a Champion](#). The techniques were compiled by Lemov after sifting through hours of video of teachers who systematically outperform their peers. Most of these techniques are conceptually simple, but have a dramatic impact on the teacher's effectiveness in the classroom. For example, when asking a question, Lemov's recommendation is to first pose the question to the class at large, allow some time to think, and then to randomly call on a student. The technique motivates all of the students to think, since any of them could be called on the spot. In contrast, calling only on students who raise their hand or calling on a specific student when asking the question allows other students to ignore the question entirely. Such techniques require no additional technology and could easily be incorporated into existing teaching programs with marginal additional cost.

Speaking of teachers, it should be emphasized over and over that they are the primary factor in good formal education. Without good teachers, education fails; with good teachers, education succeeds. Technology is largely irrelevant to this equation. As evidence, we only need to consider world-class school systems that consistently churn out high-performing students. The Programme for International Student Assessment (PISA) is the OECD's latest international measure of student performance across countries. 15-year olds are assessed on their reading and science abilities, and the test attempts to measure not just rote learning but also deeper comprehension and critical thinking ability.

Finland is among the countries that routinely perform at the top on PISA, and it is its low-tech, high-touch approach that emphasizes educational basics and relatively little use of school or homework. There are also school systems like that of South Korea that use a lot of technology and also do well, but analysis of PISA results fails to show any meaningful correlation between technology use and student performance. (Tim Kelly attempts to use Korea as an argument for technology in schools in a [May 2009 ETD article](#), but that seems an unjustified confusion of correlation with cause.) Rather, [PISA summary documents](#) highlight that top-performing nations have a political commitment to universal education, high standards of achievement, and quality teachers and principals. Notably absent is any mention of technology as a critical element of a good school system, even though the PISA survey includes questions about computers and other educational resources.

None of this should be a surprise. The world had amply demonstrated well before the invention of the personal computer that good education is possible without information technology. People born in the 1975 or earlier had no computing in their classrooms, and it would be hard to argue that they suffered as a result; many now lead the world in their respective specialties. Why should we believe that today's Nobel Laureates, heads of state, and business elite received their education because they were without information technology when growing up?

### **When Technology in Education is Justified**

In order to avoid misunderstanding, I should clarify that some uses of computers in education can be justified, although with the ever-applicable caution that while technology can help good schools, it hurts poor schools.

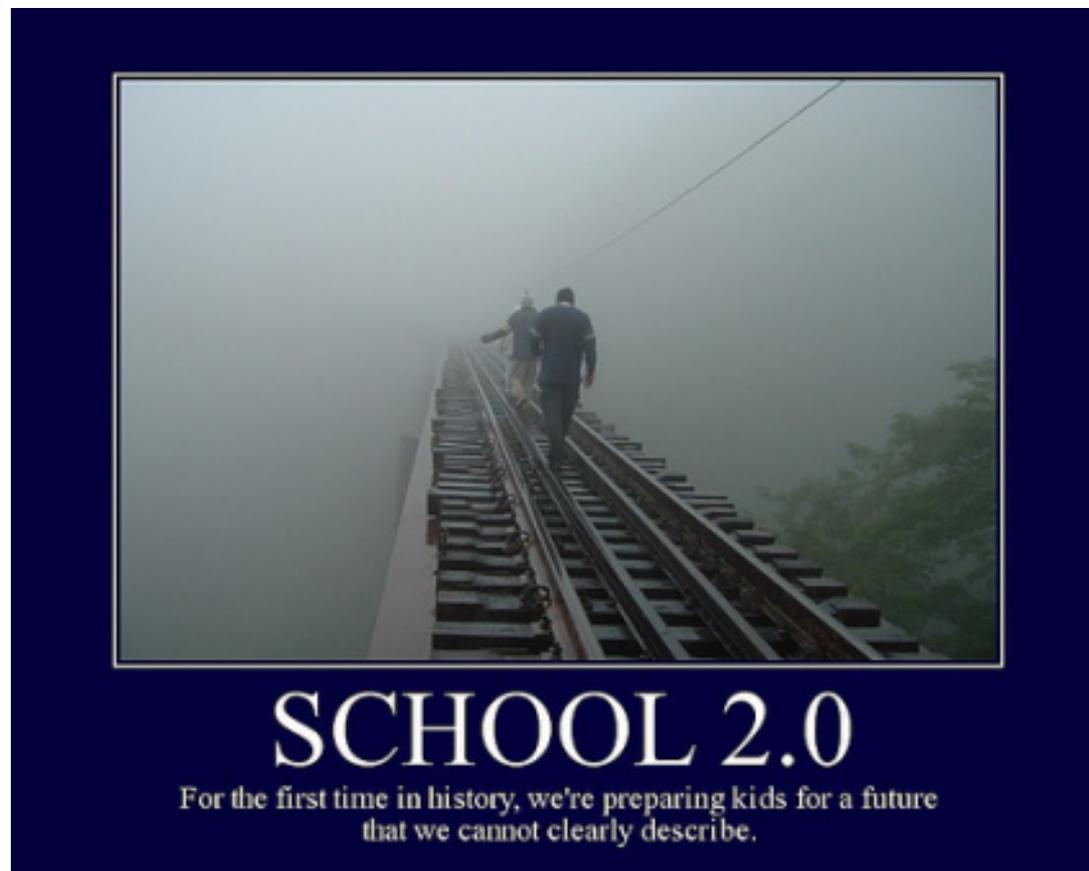
- First, in those cases where directed student motivation is assured, technology can be a useful tool to reduce the burden of teaching. Some cases of tertiary or adult education may fall into this category.
- Second, targeted use of computers in schools, for example, as an aid to teach computer literacy, computer programming, or video editing, etc., are important as long as they are incorporated only as a small part of a well-rounded curriculum.
- Third, technology can help with the administration of schools – record keeping, scheduling, evaluation, etc. – as long as the school system is able to fully support the technology.
- Fourth, in richer environments, where the cost of educated labor is relatively high,

of well-designed software may have value in fundamental education, particularly for drilling purposes. Solutions offered by, for example, Carnegie Learning fall in this category, although it should be noted again that effective use of these kinds of tools must occur in the context of an otherwise well-run school system.

- Fifth, again in rich environments, where the basics of education are assured, where students are facile with technology, and where budgets are unconstrained, widespread use of technology, even in a one-to-one format, might benefit students. Warschauer cites certain uses of computers enhance computer literacy and writing skills, but these are limited to well-run, well-funded schools; they are notably absent in underperforming schools, even in the United States.

I underscore that the last two cases are specific to very wealthy, well-run school systems. As a national benchmark, the value is unlikely to emerge for school systems spending less than \$1,000 per student per year), and that none of the positive instances above pertain to underperforming schools or to broad dissemination of technology to students.

## 9 Myths of Technology in Education



I've so far argued that technology in education has a poor historical record; that computers in schools typically fail to have positive impact (with the rare exception occurring only in the context of competent, well-funded schools); that information technology is almost never worth its opportunity cost; and that quality education doesn't require information technology.

Though I've only presented a smattering of the evidence above, the conclusions are clear. Put together, the strong recommendation is that underperforming school systems keep their focus on improving teaching and administration, and that even good schools want to consider more cost-effective alternatives to technology when making supplementary educational investments.

Unfortunately, all of this evidence doesn't provide the gut intuition required to reject the rhetoric. So, I end with a point-by-point refutation of frequently heard sound bites about technology in schools.

**Pro-Technology Rhetoric 1:** 21st-century skills require 21st-century technologies. The world uses e-mail, PowerPoint, and filing systems. Computers teach you those skills.

**Reality:** This is bad reasoning of the kind that, hopefully, genuine 21st-century skills will allow. What exactly are the "21st-century skills" that successful citizens need? Some define them as the 3 Rs and the 4 Cs (critical thinking, communication, collaboration, and creativity). But, aren't these the same as 20th-century skills? The skills haven't changed in a proportion of people requiring them.

Of course, the tools that people use at work and at home have changed, but the use of tools is easy to learn compared with the deep ability to think and work effectively. For example, no one knows, not in the 500+ years since Gutenberg invented the printing press did anyone in every school, to say nothing of every student, needed a mini-printing press to learn to read. (From the 1960s through the 1990s, schools incorporated typing half-heartedly into their curricula, but even that was relegated to a one-year elective.)

Today, any idiot can learn to use Twitter. But, forming and articulating a cogent argument in any medium – SMS text messages, PowerPoint, e-mails, or otherwise – requires good thinking, writing, and communication skills. Those skills might be channeled through technology, but they hardly require technology to acquire. Similarly, any fool can learn to "use" a calculator, but the underlying math required to do financial accounting or engineering requires serious mathematical preparation that requires working through problem sets – Einstein could do that with computers, but modern physics would be delighted to have more Einsteins.

We need to distinguish between the need to learn the tools of modern life (easy to learn, and getting easier by the day, thanks to better technology!) and learning the critical thinking skills that make a person productive in an information economy (hard to learn, and not getting easier with information technology). Based on my own experience trying to teach undereducated English-speaking adults how to use Google, I'm quite certain that their ability to capitalize on the Internet was reading comprehension and critical thinking skills, not computer literacy skills.

**Pro-Technology Rhetoric 2:** Technology X allows interactive, adaptive, constructivist, student-centered, [insert educational flavor of the month (EFotM) here] learning.

**Reality:** All of that may be true, but without directed motivation of the student, no learning actually happens, with or without technology. Good teachers are interactive, constructivist, student-centered, and capable of EFotM, but on top of all of that, they are also capable of something that no technology for the foreseeable future can do: generate intrinsic motivation in students. If education only required an interactive, adaptive, constructivist, student-centered, EFotM medium, then the combination of an Erector Set and an eraser ought to be sufficient for education.

**Pro-Technology Rhetoric 3:** But, wait, it's still easier for teachers to arouse interest in technology X than with textbooks.

**Reality:** Maybe a little bit at first. But, the novelty factor of most technologies quickly wears off, and those which don't tend to turn viewers into zombies rather than engaged learners. In addition, this comment is a real insult to good teachers everywhere. Good teachers are those who can engage students creatively, regardless of the aids available to them. Technology might amplify the impact of good teachers, but it won't fix bad teaching.

**Pro-Technology Rhetoric 4:** Teachers are expensive. It's exactly because teachers poorly trained that low-cost technology is a good alternative.

**Reality:** Low-cost technologies are not so low cost when total cost of ownership is account and put in the economic context of low-income schools. Furthermore, te cannot fix broken educational systems. If teachers are absent or poorly trained, the solution is to invest in better teachers, better training, and better administration... expensive. As they say in KIPP schools, there are no shortcuts!

**Pro-Technology Rhetoric 5:** Textbooks are expensive. For the price of a couple of might as well get a low-cost PC.

**Reality:** Anyone who says this is using American predatory pricing of textbooks as India, a typical text book costs 7.5-25 rupees, or 15-50 cents. For \$1-3, you could bu textbooks a child will need for the year. It can be more expensive in other countrie printing costs are not as low as in India, but there is no reason why a textbook nee more than a few dollars. Please, let's stop propagating this myth.

**Pro-Technology Rhetoric 6:** We have been trying to improve education for many y results. Thus, it's time for something new: Technology X!

**Reality:** Technology has never fixed a broken educational system, so if anything is it's the attempt to patch bad education with technology. If other efforts aren't wor the school system needs to be thrown out and rebuilt from the ground up, as Qata with its education ministry. There are plenty of new things to try that don't requir technology. (Though, novelty for its own sake doesn't make sense, either. There a old examples of good education, too.) It should be cautioned though, that efforts t teachers and administrators is itself a multi-year, if not multi-decade effort. Again, shortcuts!

**Pro-Technology Rhetoric 7:** Study Z shows that technology is helpful.

**Reality:** Technology can be beneficial. But, it's always worth looking at two things carefully: First, how good was the educational environment in Study Z without the Invariably, it will have been good; often, very good. This means it was secret-sauce that caused the benefit, not technology by itself. Second, what was the total cost o technology (including training, maintenance, curriculum, etc.)? Inevitably, it will 5-10 more than the cost of hardware. Both issues suggest that for ailing schools, te not the answer.

**Pro-Technology Rhetoric 8:** Computer games, simulations, and other state-of-the technologies are really changing things.

**Reality:** This article was written with current and near-term technologies in mind. that future technologies will not fit the theses. Certainly, a humanoid robot indisti from a good teacher could work wonders! More realistically, it's likely that sophisti could become richer in the range of things they can teach and the degree to which motivation. But, any such advances should pass lab trials, pilot runs, controlled ex and cost-effectiveness analyses before anyone starts advocating them for widespre no technology has met this bar – computers running existing software certainly ha

**Pro-Technology Rhetoric 9:** Technology is transformative, revolutionary, and oth stupendous! Therefore, it must be good for education.

**Reality:** This myth is pervasive because it is so easy to believe and because we wan

so badly. After all, with computers, we can publish our own newsletters, buy gifts in pajamas, and find the best Italian restaurant in town. And, it would be nice if all we was to sit every child in front of a computer for 6 hours a day to turn them into educated citizens.

But, why do we believe this? It makes no sense. We don't expect that playing football games makes a child a great athlete. We don't believe that watching YouTube will turn them into Steven Spielbergs. We don't think that socializing on Facebook will turn people into electable government officials. And, if none of those things work, then why do we keep writing, history, science, or mathematics?

A good education is second only to parenting in the importance it has in raising capable and upright members of society. We would never think to replace parenting with technology when we do at times, we do it with shame, and only because we're too damn tired (because gadgets are superior to us). Why do we keep trying to replace teachers?

### **Honesty in Technology Failure**

As if to underscore these points, last month, the Azim Premji Foundation, a well-funded non-profit in India and arguably the world's largest non-profit organization dedicated to working with computers in education, made a startling – and courageous – confession. The foundation, for over half a decade with tens of thousands of schools, providing computers, training, and designing whole software libraries in 18 languages, and integrating material with state curricula. Aspects of their programs and their software could be criticized, but their methods were thoughtful and as heartfelt as any technology-for-education effort I have witnessed. They conducted frequent research and evaluations to confirm outcomes. Their conclusion?

“[W]hen we took stock at a fundamental level, we realized that [our whole effort in computer-aided learning] was at best a qualified failure... there was practically no impact in a sustained, systemic manner on learning.”

Anurag Behar, co-CEO of the foundation cited a number of issues (the full article is available for reading), but chief among the problems were that any deficiencies in administrative and teaching were not overcome by technology. He notes: “At its best, the fascination with technology solution distracts from the real issues. At its worst, ICT is suggested as substitute to real problems, for example, ‘why bother about teachers, when ICT can be the teacher.’ From this perspective is lethal.” He concludes with a paraphrasing of what he learned from educational leaders in Finland and Canada (two countries who consistently do well on PISA): ‘we will not invest in ICT, every dollar that we have will go to teacher and school leader development and building.’”

In short, there are no technology shortcuts to good education.

*For further reading along these lines, see [10 Worst Practices in ICT for Education](#), by Trucano, as well as [education-focused posts](#) by the ICT4D Jester.*

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## 158 Responses to "There Are No Technology Shortcuts to Good Education"



**@jamesbt**

January 6, 2011

Great post, as usual, Kentaro. And thanks for the reference. But I think you may have misunderstood my thesis.

If you read the first post in my ETD series, [Sustaining Rather than Sustainable ICT](#), that I end by writing, "we need ICT4E initiatives that promote and support teachers teach and students' desires to learn." My second post, which is the one you've referenced, outlines out a process we've used to attempt to (among other things) uncover these motivations — the desires — in teachers and students. If in implementing the process does not uncover these existing motivations (to teach and to learn) then an ICT4E intervention would not be "sustaining" (i.e., it would not nourish these desires). A quote at the beginning of the second post was meant to point out, unless the motivation already exists within the community, attempts at "regime change" (i.e., behavior or process change. etc.) will most likely not be successful.

In the end, unless I misunderstand your perspective, I think we're largely in agreement that technology should be used in a way that builds upon existing motivations rather than create them.



**Kentaro Toyama**

January 6, 2011

Ah, yes, you're right! My apologies. I had somehow read the first post, but then I searched carelessly to find the second one, which I hadn't read. (Technology & capacity to do stupid things in haste.) We are in agreement. Sorry! Maybe ETD edit that bit.



**Wayan**

January 6, 2011

I've never been a fan of the "21st-century skills" argument. I've always felt that's the one, as those that are making the argument the loudest (often middle-aged techies) are on the tools they now promote, but have done quite well for themselves anyway. Think of the classes that you use as an example. I took typing class and did quite poorly – I still have my fingers crossed, looking at the keyboard, typist. I'm fast from practice, but I am not a typist. That doesn't stop me from typing up a storm on a daily basis and being something of an expert on ICT. In fact, the computer classes I took in middle school on BAISC are all but useless. Those classes actually had me hating computers for years until I found email in college. That was useful, but even more so was the reading and writing skills that made email an effective communication tool for me. Better is focusing on solid critical thinking skills, which are often helped by technology, but will be developed and honed with a real, live teacher.



**Kentaro Toyama**

January 6, 2011

I agree. You're making arguments that go even further than mine... that the critical thinking skills are so important, that in comparison, digital-literacy skills are a negligible portion of a healthy adult life. This happens to the point that bad things can happen in digital literacy, and you can still come out doing very well, as long as a certain capacity is in place.



**Merryl Ford**

January 11, 2011

Hmmm... I really like this article and agree with most of it. Re digital literacy "21st century skills", it's really difficult to judge just how important it is and I have mixed feelings. On the one hand, yes, it's quite easy to develop and "learn" some of these skills. However, youngsters in the "developed" world grow up with sophisticated advanced technologies (mp3 players, mobile phones, PCs, gaming devices) and are totally at ease with them. Their use of these technologies is natural and an extension of themselves. In the developing world (and my experience is in Africa), because of almost no exposure to all these technologies (except mobile phones), there is no intuitive use and no knowledge of what is possible. There is no opportunity to collaborate, debate, challenge, no exposure to different concepts, cultures. Your teacher and textbooks control your thinking. This worked in the past when we were at school, but the world has changed dramatically and new skills are needed to navigate this new world. Without digital literacy and exposure to technology that becomes intuitively a part of how things happen, children in the developing world are at a distinct disadvantage to their peers in the developed world. So I guess what I'm saying is that I believe digital literacy is important in order to nurture and develop critical thinking skills – to what extent I'm not sure yet.



**Mike Dawson**

January 6, 2011

Interesting article well grounded in the reality of implementation as it is now. I think it's important to have with the conclusion that technology doesn't enable more rapid progress than otherwise possible in poor countries.

ICT4E or anything else, many countries are not the kind of operating environment that allows themselves to efficient use of resources and are extremely difficult to operate in (see the challenges, power, human capacity, etc).

Where we are in Afghanistan, for example, we have an average school day of 2.5hrs due to the shortage of teachers / schools. Using OLPC with a blended learning model and interactive curriculum material you can double that almost overnight. Other models require far more time for building teacher training capacity, then doing the teacher training, then trying to see that what was trained is actually being implemented. Lack of sufficient resources, on task and feedback, critical components of an effective education are lacking in many

developing countries.

I agree completely with the historic perspective. Rewind a little more and more ge almost like the railways. Everyone loses their mind thinking that a railway is a lic money, and builds in some instances three lines between the same cities and two crippled by infrastructure overheads. New technology only expands the options of possible and does not remove the need for carefully considered solutions impleme good understanding of the current challenges/opportunities.

Like many innovations ICT4E requires further mini innovations in content, training implementation in challenging environments to become truly viable.

In my opinion what it really needs is to be compared to the 'standard' arsenal of tc improving education and judged on a measurable return on investment basis, any could spend money on to improve education – teacher training, school constructi meals, enrolment campaigns, curriculum development, etc.



**Kentaro Toyama**

January 6, 2011

Thanks, Mike! And, it's great that you are working on education in Afghanistan superb teachers in an otherwise underfunded educational system can do great they can use technology to help them. María, below, also raises this possibility.

But, what I'd like to caution against, is any suggestion that that model is replic conclusions from cases like this go. First, Mike Dawson, working with other de might make magic happen in a single school, or even a cluster. But, Mike Daw missing in the rest of Afghanistan (or, we wouldn't be so concerned in the first replicate Mike Dawsons everywhere requires a more mundane investment in a educational system. (continued...)



**Kentaro Toyama**

January 6, 2011

Second, I can't agree that \$100 (to say nothing of TCO) per student makes hardware that might last 3 years, in a country whose per capita GDP is less That is a bigger deal than spending \$10,000 per student in America. That n go first to micronutrient supplements, vaccinations, building schools with textbooks for teachers, and (dare I say?) an effective army.

If someone donated the laptops to you, I wish you only great success! But, counsel the donors, I would tell them to use the funds for something with positive impact and greater reach. There are many other possibilities, e.g. <http://poverty-action.org/provenimpact>



**Eleonora Badilla**

January 7, 2011

There are no sort cuts to good education.  
But there is no good education without good teachers, good books, an use of digital collaboration technology DCT.  
Eleonora Badilla Saxe



**juanslayton**

January 8, 2011

I don't know Eleonora. I got a pretty good education back in the 50's from the teachers and books.



**Wayan**

January 14, 2011

If we really want to go back, Socrates, Plato, and Aristotle built the foundation of much of our thinking – without electricity and the Internet. Socrates, a deep mistrust of books. So I'd say it's good teachers are the key here. If we have that, then tools like ICT can really expand our skills. Of course, how we use technology is as important as what we use



**Oscar Becerra**

January 17, 2011

But you grew up in the 50's you did not have to grow up now, with CD's, no computers or microwave ovens, etc. etc. Not because your grandmother cooked in her coal oven means we should be doing that today no matter how good was it back then



**eltservla**

January 6, 2011

PART 1

I am afraid this will be yet again a long posting but it will only go up to the sub-heading TECHNOLOGY IS JUSTIFIED because I must get on with my work for today. Will see you half tomorrow.

Before I start I would like to thank Mr. Toyama for yet again another thought-provoking post.

'There are no technology... are not in question'

MY COMMENT: Am not sure about this. Have seen teachers who are properly trained perform miracles in underfunded schools with limited infrastructure.

'To back these assertions.... without much technology'

MY COMMENT: If we are thinking of the benefits ICT can bring to Education, we must first ask what kind of educational principles underpin the integration of ICT into classroom practice. I assume they can only be used when all the equipment is perfect.

'In particular...futile'

MY COMMENT: Totally agree, because it is being done for the wrong reasons

' All of the evidence.... twelve school years'

MY COMMENT: . And what makes “good teaching?” We need a definition here

' While computers appear... bound to fail'

MY COMMENT: Cannot follow this. Seems to reflect a very authoritarian and paterfamilial view of teaching.

'With respect...carnival'

MY COMMENT: Think you are thinking of technology as a sort of miracle worker in the case. It is just an addition to classroom activities.

' They reveal....over and over'

MY COMMENT: I would rather say that it is because we are not clear as to: a. what current technology can bring to the classroom; b how it can help generate more interest in students.



**eltservla**

January 6, 2011

PART 2'One point...outcomes'

MY COMMENT: Because this requires planning, not just plonking a bit of technology in the middle of the classroom.

'The hubris...on their promises'

MY COMMENT: . Has this been researched? What were the original goals of introducing technology in the classroom?

'if anything...power'

MY COMMENT: How so? Because we had not analysed how it could be used?

'...of generating....for education'

MY COMMENT: The question of motivation in Education is an area that has been abused and never understood. Motivation goes together with a set of Educational Values. The aim to develop the learner as an individual, where he is taken into account and given a choice in the classroom, where he is encouraged to learn how to learn, who works in a non-competitive environment where the teacher shares the learning process with the students, etc

'Today...solution'

MY COMMENT: Digital technologies can also be passive, depending on how they are used. The same could be said of TV and videos in the 20th century.

'..key challenge...regularly

MY COMMENT:That is the fatal mistake. Assuming that Motivation can be generated by external stimuli or by the teacher. Can't remember how many times I have heard 'I need to motivate my students', or ' Nothing motivates them' Of course motivation is 'extrinsic' e.g. the need to get a certain qualification, or “intrinsic” the satisfaction that comes from what he/she learns and how it affects his/her view of himself/ herself' At the heart of motivation, the engine that drives human beings forward.

' Computers can...invariably fail'

MY COMMENT: This is again because technology is not being used appropriately. In most of the projects I have researched lately, students have been given a computer made to use it in the same traditional way as they used blackboards, i.e. controlled

teacher “ now turn on your computer and do this...” ‘ now turn off your computer not what computers are for. The idea is that students are encouraged to use computer as a ‘discovery tool’ where they can share conclusions, agree and disagree with each other and generate a final outcome that is the result of their exploration.



**eltservla**

January 6, 2011

PART 3

'...placing computers...counterproductive'

MY COMMENT: .” Of course, if you place a computer in front of a student and don't give him with a task to do with it, you cannot expect any results. It also implies that the classroom has not been thought through properly apart from making sure that connectivity, etc.

‘...this is a specific instance...teachers’ needs'

MY COMMENT: .) I would like to see that research. What educational view was it based on? Were teachers trained to use computers? What role did computers play in the classroom?

'Ana Santiago....achievement'

MY COMMENT: Here again, how was academic achievement measured? Which was the goal set? How can impact be evaluated if there are no clear goals to evaluate results against?

'Santiago....device'

MY COMMENT: Totally natural. They were not getting anything out of the process.

'But...solution'

MY COMMENT: Totally agree. If technology is used as a band-aid to cover up for other deficiencies in the educational system. The decision to incorporate technology in the classroom must be a conscious process of “innovation” where: a. a clear Curriculum is designed to incorporate the use of technology; b. all stakeholders i.e. students, teachers, school administrators and parents are made aware of how it can contribute to the teaching process; c. there is ongoing feedback from all stakeholders that will help identify what works and what is not. This is one of the basic premises of “implementing innovation” which Mr. Toyama is aware of. And incorporating ICT to classrooms should be treated as such.

'As Wayan.... students)

MY COMMENT: At the risk of repeating myself, I would insist that a. the word ‘model’ has not yet been defined in this paper; b. innovations have to be introduced carefully and not imposed top-down. Have seen many educational innovations both in European countries such as Spain and Italy and in Uruguay where I currently live, collapse due to bad planning and implementation and through insisting on making it a top-down imposition.

'Educators...technology'

MY COMMENT: I am afraid I cannot go on repeating the same. People who are not experienced and trained cannot give a valid view of the role of technology.

'The first...far greater'

MY COMMENT: I agree. As I think I said above it is like trying to cure a bullet wound in the stomach with a band aid, leaving the bullet inside.

'The issues...cost'

MY COMMENT: Not just that. The fundamental issue is being clear as to the role of technology in the classroom.

the teaching/ learning process.

'...technology's supposed... technology'

MY COMMENT: They probably are because they have not been properly informed

'Speaking of teachers...equation'

MY COMMENT: It is not. Quite the opposite. It adds a different dimension both to the teacher's role and the student's role. And anyway, we are still talking in the abstract, What is a good teacher? Judgement is being passed without any definition of what being a good teacher is.

'As evidence... ability'

MY COMMENT: And precisely, one of the many contributions using ICT in classrooms is that students develop their cognitive skills.

'Notably...resources'

MY COMMENT: This is mainly because they are taken for granted and part and parcel of the educational system, especially in countries like Finland and Korea.

'...good education... technology'

MY COMMENT: Again, we need a definition here. What is good education? There were many people like Dewey and Stenhouse who wrote about Education long before computers existed. The concept of "good education" was clear. I attach a link to a film I found in YouTube about Education in the 40's in the USA. I think it is a jewel and it shows clearly that 'good education' did not need technology, it needed principles which most of the world seems to have forgotten about.

<http://www.youtube.com/watch?v=opXKmwg8VQM>

'Most people...growing up?'

MY COMMENT: I am afraid I don't see the relevance of this question. Of course you can grow up without computers, however, in my personal case, I would feel very isolated from the world around me if I did not have access to a computer as it reflects the direction in which society is moving. I have many older friends and colleagues who can barely use a computer, but they use it to open their emails once a week. They have simply decided not to keep up with the times.

And I shall stop here for today. I hope you don't find it as taxing to follow as I found it. If it does not work, won't do it again, But I normally study like that, I write comments in the text so that the comment can be linked to the text.

Best regards,  
María Sara Rodríguez



**Kentaro Toyama**

January 6, 2011

Thanks, María, for your extensive comments! I won't respond to them all (some are addressed elsewhere in the article), but I will answer two of the issues, which you accuse me of not defining — "motivation" and "good teachers."

"Motivation," in the case of education, it is that which causes internal "movement" in a student to do things that allow them to grow in knowledge, skills, and maturity, and wholeness as a human being who attains his or her unique potential. It is that internal student that causes them to exert effort.

Bad teachers fail to do this in any form. They might be totally absent. They might

They might be well-meaning, but misguided in their pedagogy. They might be incompetent. Whatever it is, they don't add positive impetus for the student to what is necessary to learn. Sometimes, they may detract from it.



## Kentaro Toyama

January 6, 2011

(...continued) Good teachers have a net positive contribution to the child. Some teachers are good, but not great. I count strict disciplinarians who fit in this category, because at least they can enforce classroom discipline and get students to memorize things. The process of memorization also builds self-discipline, and self-confidence. It's not optimal, but better than any bad teacher above. With the proper training and curriculum, I'm sure they could also cope with computers.

Excellent teachers "provide" motivation through inspiration, encouragement, challenge, subtle discouragement, occasional scolding, occasional punishment, even calculated aloofness to allow students to grow on their own. They help learning fun, and they bring out the student's own aspirations and potential. They create a lesson out of an acorn, and turn a child's fascination with mushrooms into a year-long investigation. It is an intricate, highly customized art.



## Kentaro Toyama

January 6, 2011

(...continued)

My basic claim is two-fold: First, that good teachers might be able to do more positive with computers in their classrooms, especially when provided with other necessary support; excellent teachers will be much more likely to do more things with computers; but, bad teachers will only let computers get in the way. Second, no technology for schools with bad teachers, which unfortunately, is the case in the great majority (though certainly not all) of publicly funded education in developing countries and low-income communities in developed countries. Second, even for most good teachers, I think it makes more sense to invest a potential budget for technology towards helping good teachers become excellent.



## Mike Dawson

January 7, 2011

Thanks for the compliments! A couple bits of food for thought:

1. To what extent an intervention depends on the capability of the user depends on how much one understands their situation and provides guidance for effective usage. Throwing out any educational intervention without guidance (television programs, laptops, etc). If like we do here you have a complete interactive version of the same curriculum book but with games and exercises then it doesn't take too much familiarity with technology or imagination that might have long ago been destroyed by learning mentalities.

Actually until I show people the interactive book people here are

thinking "why on earth would you do that?" Then on seeing interesting materials that can be used at home it makes sense to people.

2. TCO is the real tough cookie. But why are we thinking only of cost business and agriculture information can help cottage industry their incomes! Learning a foreign language and things a roleplay game or a job interview can get more people better jobs where such education otherwise difficult or expensive to come by.

3. Whenever there is a new innovation there is a significant amount of entrepreneurship required to determine how best to use the new technology. That's nowhere close to completion. Once that innovation comes that can provide a reasonable ROI then it should be piloted, assessed and scaled. One might also look at the Plug N Pray guide written – see <http://www.paiwastoon.af/PAIWASTOON-AF-PlugNPray-Guide>.



**Oscar Becerra**

January 17, 2011

You are right, without motivation there is no possible education and without it you can learn no matter how hopeless their situation may seem. I like to quote Nietzsche "Those who have a why can bear any how" (Crepúsculo de los Ídolos). What is really important to me is that ICT seems to provide motivation when it is absent. We have measured the Intrinsic Motivation Inventory in about 14 schools in our new Laptop per Child program and all variables increased, some of them by 100%. Of course bad teachers will always be a problem and we'll have to work to improve them but it takes a lot of time and effort so something needs to be done to help them improve.



**Ron**

January 6, 2011

Well done, as always. Your works are always interesting to read with very thoughtful



**Kentaro Toyama**

January 6, 2011

Thanks. (I hope you're not a blog spamming bot.)



**RLD**

January 6, 2011

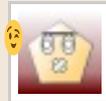
Okay, Kentaro. You asked me for a little comment. My background is 6 years as a student at a one room country school house (1947 -1952) and I still get a Christmas card from them. I have an MA from W.Mich Univ in Mathematics education and an MS in Computer Education from U of Oregon with Dave Moursund. I have taught (and been a consultant/reader/grader) for both AP Computer Science and AP Statistics. Now retired.

I find agreement with so much that you write. Of course, computers are vital in today's world but I have always had an apprehension about the extreme jumping on board movement in education. One of my favorite short stories is Asimov's, "A Feeling of Power". I use it often in my APCS classes. In math we saw the TI-81-82-83-85-89 etc, etc, etc. And so parents have to buy a new version for their kids. Naturally computers have gone the same way and now parents have to buy new ones of these. I can remember an AP student back in the 80's talking about his ultimate computer having 10 Mgs of memory. Of course this was in the days of big floppies and 128 K was a big deal.

I have been associated with a school that spends tons on computers and is also giving in many respects it has been used well, but there was/is also lots of overkill and underutilization, important, too.

I can remember back to the early 80's I edited a "magazine" for a fledgling computer group of schools. In my editorial I was very cautious about an onrush of splurging in the computer field without some good discussion and planning about is it really needed to do things better. I found in my later years of teaching that I was actually withdrawing computer/tech use—I'm sure to the consternation of some of my colleagues.

I find the Finland school system to be a very interesting study. Keep up the good work.



**Kentaro Toyama**

January 6, 2011

Thanks, Mr. D! It was great to have you as a computer science teacher in high school that was why I came away with a curmudgeonly, er, level-headed view of technology in schools.

All kidding aside, it *was* a great advantage to have a computer science class in a lab with one PC per student, and it undoubtedly played a role in my eventually getting a computer science PhD. And, it was also terrific that the computers were only available every other day, and that the rest of the school believed (then) in the power of books to inspire and motivate, and the importance of focused time for students to do their homework, sets, write their essays, and practice their musical instruments.



**Raj Parihar**

January 6, 2011

[PART 1]

Nice article and most importantly based on some ground realities as opposed to random thoughts which often emanate from multi-billion PC makers' offices.

I must point out one thing which is: "Who do you think, believe that Technology is needed for good education". As far as I know, by and large, a larger crowd doesn't believe this line. They pretty much know that the bridge between technology and basic education system is really large. They are orthogonal to each other in many aspects and important.

another is not so apparent. Except the people who want to sell technology to "education market" and some of people who get benefitted by that. Other than them no one else is interested in the integration of technology into education-system. I am sorry to point out, but not that company X who builds OS Z, does that very often. This is based on my observation that I saw few computers running with Z in my primary school which is hardly able to do basic things for teachers and other basic things.



**Kentaro Toyama**

January 6, 2011

Thanks for your note, Raj. But, I won't have to do much to answer your question. Lots of comments will come in from people who are sure that technology is necessary for schools for students to be prepared for the modern world.



**Raj Parihar**

January 6, 2011

[PART 2]

While you have answered many questions and cleared many doubts, I still feel that a few stones are left unturned. In order to counter the counter-arguments you could have shown some things. Pick an educational system, in the context of India, it could have been — a — an RSS operated Sarswati Schools. With minimal technology they do much better than convent or privately held richer schools. Ask any kid in India and he/she will tell you that even at college level take an example of BITS system. As per my knowledge, the classic old-fashioned, techers avoid technology as far as they can, yet you can find student system in any corner of the world. In contrast to that, there are many other universities in India which are much richer i.e. Manipal, Dhiru Bhai Ambani University yet they did not reach a mark which BITS did. It solely relied on good teachers and great methodologies and educational practices.



**Kentaro Toyama**

January 6, 2011

Yes, I agree. There is really no end to good school systems with minimal use of technology. In India, there are examples like Rishi Valley, which has an ingenious program based self-paced worksheets (overseen by dedicated teachers) that students learn. There's Shanti Bhavan, which is expensive, but spends almost all of its resources on a boarding school for dalit children. (They have a computer lab, but it is for individual use about computing.) I also agree that India is an example where many top engineering colleges do amazingly well with few computers. (But, I think they could use more computers; it's hard to become proficient at programming without reasonable experience.) But, overall, I agree with you.



**Raj Parihar**

January 6, 2011

[PART 3]

Again, people who harbour the thought that technology can really make a big impact from reality. I feel that their motive is to sell their technology to "unexploited" education and make money. One thing they fail to understand is that education is not a business. Marrying their business with educational business would turn into a disaster. Education should be a social-business where the profit comes in form of goodwill of society and not in dollars.

Most important thing, while technology is not a solution. Good teachers are. But getting good teachers is not enough. What else needs to be done is the complete overhauling of the culture and setting up the right examples along with sustained motivation. One should ensure that the system should encourage good practices more importantly it should discourage bad practices or else the system itself would set up the wrong examples.



**Raj Parihar**

January 6, 2011

[PART 4]

In order to present some concrete example, some of my good friend of mine, dropped school after 10th and entered into a diploma course. The motivation was that with secondary/specific education you can make life much better, start earning early etc. but they regret because the benefits were stagnated. On the other hand, who continue in the same direction and kept patience are in much better situation today. So it is very important to give a good perspective to the young kids and their directions so that they don't follow the false path.

Unfortunately, all this can not come from a good teacher alone. In order to really make an educational system effective one also needs to examine the external factors which include the school, company, parents and their guidance, social circle, teachers, and rewarding system.



**ereaderstudent**

January 7, 2011

This is a very thought-provoking article; I will surely keep this article bookmarked. The article really points to the need for evidence-based solutions. Education organizations spend countless sums of money on unproven technologies. Unfortunately, with limited resources in education, spending money on ineffective solutions to learning problems reduces the money that could be spent elsewhere. There are many levels to technology integration in the curriculum, but the core tenets of adoption should be evidence of efficacy, and that we know how to effectively use technology to augment learning. Often, neither tenet is met.

Technology must be additive, and proven so before implementation. Too often, technology masquerades as a solution looking for a problem. Moreover, technology is too often used as a solution to a problem that cannot be solved with technology. Many learning issues are comprehensive and difficult to address. The lure of technology is a perceived quick fix. Seeing that now with a lot of the mobile tablet devices. Many schools have adopted technology without any evidence of learning value, and some freely admit they are just experimenting. This includes well-established Ivy League universities that thrive on research! This is like the shoemaker's kids with holes in their shoes. Our leading educational institutions are among the worst offenders of technology adoption without any solid evidence of the learning value. Technology is a vehicle, not a comprehensive learning solution. Those schooled in

technology understand this, but are all too often drowned out by the marketing hype that become understood by the public as factual. Urban myths abound when it comes to educational technology. When technology doesn't provide the benefits, don't blame the technology. If you take an improper medication for an ailment it cannot treat, don't blame the medication. But yet, we continue to throw dollars at technology hoping for something to come out of it, little more than trying to win a lottery; most people lose. We need to continue to build a body of knowledge about instructional technology, and convince educational organizations to base adoption on empirical evidence, not speculation, anecdotal accounts, and marketing messages.



**Kentaro Toyama**

January 7, 2011

Thanks, e-readerstudent. I completely agree.

I think experimentation is perfectly okay, but experiments need to insist that they are, with clear decision points (with concrete bars) beyond which the project can't contract or expand.

The current mass excitement around the iPad in schools is unfortunate and try to find some quotes from a New York Times article

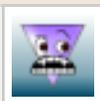
<http://www.nytimes.com/2011/01/05/education/05tablets.html>):

Start with overblown statements of value: "It allows us to extend the classroom beyond these four walls," said Larry Reiff, an English teacher at Roslyn who now posts his materials online."

KT: So, were textbooks and worksheets limited to the classroom before?

Another one: "It's not about a cool application," Dr. Brenner said. "We are talking about changing the way we do business in the classroom."

KT: And, exactly how? (continued...)



**robvanson**

January 7, 2011

A long article with a pessimistic or even depressing message. I have to agree with the facts supplied. However, I disagree with the conclusions.

I have many comments and remarks, so I will enter separate comments for each statement.

My first is with the (implied) message that technology never really helped education. I will take my home country, the Netherlands as my example, as that is the one I know best. The focus will be on secondary education, ie, high school.

The Netherlands are rich and have ample teachers and classrooms. What technology did they have that said to have revolutionized education over, say, the last century?

1 Electric light and central heating. This allows us to teach during the dark and cold winter.

2 Public transport and bicycles. This reduces commuting time and allows all children to fit into a fitting school in our German style differentiated high school system.

Without these four technologies, education in the Netherlands would grind to a halt.

Some lesser technologies that improved life of students and teachers

3 Watches, to keep tight teaching schedules

4 (Mobile) phones, to keep down on truancy, inform about absentees, inform students about last minute lesson plan changes (using a calling chain), and help each other with assignments.

5 Graphing calculators (obligatory for students). These are used in math and science. I have no idea whether these calculator really do improve understanding in most areas. I know that it is next to impossible to teach realistic statistics without them.

6 Computers and the internet (just a first shot at them). Children are required to have a computer and broadband internet. When asked, they say it is impossible to graduate without them. This requirement is usually not a problem, as nearly every household has both. Computers and internet are available at school for those who need them. Computers are used to do homework: word-processing, internet searches, small educational programs (or on a CD), tests, and communication with the teacher using Blackboard/Moodle management software. Obviously, if you do not understand your homework, your teacher is just a chat room away. Just call or text them to get online (which they most probably will) and ask them for advice.

What do these technologies have in common?

They all make that students spend more time learning, either in class or at home. They make that teaching is possible when it is dark and cold outside, or spending less time commuting to and from school. And we should not underestimate the increase in efficiency that comes from tighter class scheduling and more flexibility in teaching hours. And if you are stuck on homework, there will be someone able to help you, somewhere.

We can debate about the best measure of educational performance until the cows come home. But the first thing that matters is that children spend time learning. The more time they spend learning, the better they will master what is being taught. All the rest is just details of importance. And every technology that increases the time spent teaching and learning is educational technology. (see also the ETD Assessing ICT4E evaluations <http://edutechdebate.org/archive/assessing-ict4e-...>)

What is very remarkable? That the technologies that have streamlined education and made the lives of teachers and students much, much easier all fall outside the scope of the "Technology in Education" discussion. Because, all this lamenting is about doing things INSIDE the classroom other than teaching. But teaching is done in the class, learning at home.

More to follow



**Kentaro Toyama**

January 7, 2011

Thanks for your comments, Rob!

I should note that I don't think technology is useless in education or elsewhere.

stand by is that technology amplifies existing human/institutional intent and (See, for example, [http://bostonreview.net/BR35.6/ndf\\_technology.php](http://bostonreview.net/BR35.6/ndf_technology.php) .) In education, this means that it amplifies pedagogical capacity of teachers and so pedagogical capacity is high (a relative term, to be sure), technology can contribute positively. If low or non-existent, technology won't help.

This is not pessimistic with respect to technology, per se. It's pessimistic with any attempt to "fix" a broken institution with technology. Unfortunately, that majority claim of the value of technology for developing countries.



**robvanson**

January 9, 2011

I understand, and agree, with your amplification theory of technology.

But I chose these examples because they also tell how this works. Central lighting, and good transport (public or bicycles) help ALL children. Also the schools. Indeed, if nothing is taught, nothing will help. But it is not that because something is taught in school, you can still help.

And education is not a zero sum game.

Even if the strong will get much more out of any improvement, it is still worth help the weak. With more education the weak will become more productive more. Even if their relative position on the educational market decreases.



**robvanson**

January 7, 2011

## Part 2: On the waste of Public Libraries

A large part of the complaints against ICT programs for education are about the use in the classroom. Everywhere in the "debunking of technological solutions" we read words like "out of class" and "in school".

When we limit the discussion so severely, we can show almost anything. So let's give an example: The waste of Public Libraries

Many communities and schools spend money on public libraries. Every school, neighborhood, and village in my country has one. They are claimed to improve the educational level of children.

This is a waste. I have seen many lessons, classes, and spoken to many children. They do not use library books in class. They are not incorporated in the curriculum and teachers hardly make use of public library books in class. So we should close these libraries down and save money in teachers.

What is wrong with the above evaluation? Everything.

We know we need libraries to keep children literate. To learn how to read, it is para

children read a lot. I remember some study that said that a child needs to read for 4 to be at a level to stay literate. To get children to read, you have to supply texts, books whatever. And the texts should be interesting to the child. So you need a large choice each child can find many books that it likes. And it should read these books at home in class. Reading books in class is a complete waste of (teacher) time. And teachers can substitute for library books.

To conclude, without public libraries, no literacy.

So here we have one example of the fallacy of "in class use". In class, children show paper, and teacher, and maybe a text or work book. A laptop that includes all of that qualify. But everything else is a waste of teacher's time.



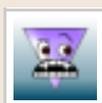
**Kentaro Toyama**

January 7, 2011

Public libraries are terrific for communities that can afford them. (Though, I'm not sure you need libraries to achieve literacy.)

And, I agree that time spent learning is an important aspect of education. (More technology generates more time spent learning.) But, I disagree that electronic technology is necessary or cost-effective for encouraging more time spent learning.

Note that this is in no way a critique of people who have grown up with and love technology. I'm certainly among those people. But, I think it's important to recognize that the privileged this class is, with respect to the immensely positive human and institutional factors that we are blessed with, and in whose context the technology does well. Against very-low-budget, publicly funded education systems that I've seen or read about (in Africa, and poorer parts of Latin America), those human factors are not yet present consistently enough for technology to amplify positively.



**robvanson**

January 9, 2011

My main point was first that measures of "in-class-use" are completely unhelpful in evaluating the influence on school performance. I believe most learning happens at home, especially if children get older.

Public libraries might not be the only ways to get children literate. The important thing is that children practice reading, and practice a lot. For that you need things that children like. Books and comics are good. Periodicals are good too. Libraries are one method to distribute large amounts of reading materials that cater to a wide range of interests. But they will never show up in in-class-use statistics.

But if there is nothing useful or interesting to read, children will simply not practice to become proficient readers.

And I do not advocate replacing libraries with electronics. I rather sent a teacher with books and a catalog. But if electronics (eReaders etc) do the jobs most cost-effectively, be it. I really do not care how the "books" reach the children.



**@jamesbt**

January 20, 2011

On the issue of time spent learning, it is one hypothesis posited for the in-  
outcomes in blended and purely online approaches in the [US Dept. of Ed  
meta-analysis of online learning \[PDF\]](#).



**robvanson**

January 7, 2011

### Part 3: On Television

Television makes a very good target for deriding technology. As such it is a focal po  
showcase the failure of technology to improve life and education. I want to step up  
defense of TV.

I have commented extensively on the revolutionary power of TV here on ETD "Litr  
and New" (<http://edutechdebate.org/archive/literacies-old-and-new/>). See my co  
"You May Eat Too Much, But You Can Never Know Too Much"  
([http://edutechdebate.org/literacies-old-and-new/you-may-eat-too-much-but-yo  
know-too-much/](http://edutechdebate.org/literacies-old-and-new/you-may-eat-too-much-but-yo<br/>know-too-much/)) for details.

For the current debate, I would first like to point out that Television has brought al  
revolution in the developing world. Just read "Revolution in a Box" by Charles Ken  
([http://www.foreignpolicy.com/articles/2009/10/19/revolution\\_in\\_a\\_box?page=fi](http://www.foreignpolicy.com/articles/2009/10/19/revolution_in_a_box?page=fi)  
lot about the life-changing influence of television that is not apparent to the casua  
from the developed world (eg, USA).

But I would like to restrict myself to education, TV helping teachers. In the Nether  
are several programs for "School TV", which have a limited impact to say the best.  
three "educational" broadcasts with a high impact: Sesame Street for pre-school  
(<http://www.nps.nl/nps/sesamstraat/>), Het Klokhuis for older children (6-14 yo?  
(<http://www.hetklokhuis.nl/>), and the Jeugdjournaal (Youth News,  
(<http://static.nos.nl/jeugdjournaal/voorpagina/>). Although disadvantaged children  
these less than children who would not need it, they are quite popular all around.  
made to get these disadvantaged children to watch these programs. But I do not w  
about these neither.

I want to talk about the very high beneficial impact TV has had on Dutch educatio  
that shows up in all the educational statistics compiled internationally.

Dutch and Danish children tend to be top of the league in English proficiency, wo  
Dutch and Danish children have much better English proficiencies than German  
might look puzzling, as all three countries share the same socio-economic statisti  
educational systems. The one relevant difference is that Danish and Dutch childre  
of English shows and movies with original sound and sub-titles. German children  
same shows and movies, but dubbed in German. This fact alone is able to explain  
in English proficiency.

Here we have a case where children who watch more television and movies will ha

better English proficiency, that is, better academic performance. More about this c  
in "What We Can Learn From Foreign Language Teaching in Other Countries" by I  
Nancy C. Rhodes, And Donna Christian  
([http://www.cal.org/resources/digest/digest\\_pdfs/0106-pufahl.pdf](http://www.cal.org/resources/digest/digest_pdfs/0106-pufahl.pdf)).

This finding is well attested by linguistics research. The more you hear a foreign lan  
better you will understand it. As a side note, subtitles also teach speed-reading very  
have seen no scientific data on that.

In short, all the attacks on TV as the epitaph of technological failure are unwarranted  
communities of the world, the television has proven the revolution that was prom  
there would be one, evidenced based, advice we could give to a developing country  
get its children to learn a new language (be it English, Spanish, Hindi, or Mandarin  
would be to start broadcasting soaps in these languages, with subtitles.



**Kentaro Toyama**

January 7, 2011

As I said, television is a great means for disseminating information. And, I also  
that it has had many broad positive impacts (see, again, the brief discussion in  
[http://bostonreview.net/BR35.6/ndf\\_technology.php](http://bostonreview.net/BR35.6/ndf_technology.php).... However, as a tool fo  
fundamental education, it has failed exactly where education otherwise fails d  
institutional problems.

It's not that TV (or other technology) can't be used for positive ends. It's that t  
part of the equation that makes technology's contribution positive is ultimate  
institutional, and that when those aspects are broken, technology will not fix.



**robvanson**

January 9, 2011

Personally, I agree with Charles Kenny that television is already working to  
ends.

We do not have to do something, it is already going on. No one tried to int  
improve English (and other) language proficiency in Dutch and Danish cl  
was just a side-effect of the general influence of TV: Get viewers in contact  
people.

I did not even touch upon one of the most important educational effects c  
disseminating standard language use and increase viewers vocabulary size

That TV might be useless in targeted education is not something I will cor  
consider random attacks on "TV as the pinnacle of wasted time" a kind of  
men.



**edtechdev**

January 7, 2011

It's very easy to criticize – too easy. You are against technology in schools, although you don't define the term and conflate computer technology and technology in general.

If you are against technology in schools, what are you for? The only implied alternative is to turn back the clock. Larry Cuban, turn back the clock in schools to 1980 before computers, or perhaps you are like Neil Postman and want to turn back the clock to the 17th century before textbooks.

You don't seem to object to reading and writing – that involves technology. You are lecturing in a classroom – a classroom is a designed technology. You are against "technology in schools", even though schools, too, are designed technologies. As I've even argued elsewhere, the classroom itself is a technology: <http://edtechdev.wordpress.com/2010/01/21/teaching-is-a-technology/>...

I won't try to address the rest, but one thing I'd respond to: "Technology might have a positive impact on the impact of good teachers, but it won't fix bad teaching."

Again, what is the alternative. The implied alternative is basically the proposals of Rhee and others – we just get rid of the bad teachers and everything will be fixed. How do you identify bad teachers? No one knows. And is there any evidence for this strategy? No.

Teachers are human. Teaching is a human activity – and just saying we'll simply get rid of the 'bad ones' sounds too much like you are treating them like, technology.



**Kentaro Toyama**

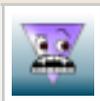
January 7, 2011

Thanks, Doug, for calling out some sloppiness in the article.

In this article, "technology" refers primarily to ICTs or electronic technologies. I'm for books, printing presses, pencils, pens, and even computers when applied in the right ways by competent schools. What I'm for is a strong base of human and institutional capacity first, foremost, and for a long while after.

I don't think I expressed that we should get rid of bad teachers — What we really need to pour more attention on the process of encouraging, recruiting, hiring, training, and mentoring teachers. (Perhaps occasionally, we have to fire teachers, as well, and fix broken systems, a lot of that may be necessary at first.)

My main recommendation here is that most schools in the world would cost-effectively benefit by focusing on the human factor in pedagogy, rather than on technology. Good teaching as a technology — in many ways, good teaching is the opposite of technology in that it is caring, creative, non-repetitive, ultra-customized, and ultimately about people, not simply making things easier for them.



**robvanson**

January 7, 2011

Part 4: On New Teachers

This thought provoking article advocates a solution to the worrying state of education in the developing world: Invest in more teachers and more schools.

I sincerely doubt whether this is actually feasible. I even fear it is completely impos

Let us look at the numbers. I have read somewhere that around 900 million children in the developing world receive inadequate education due to a lack of schools and teachers. If we have 600 million or 1200 million, that does not concern us now. Let us take 900 million as a round number.

To get education for these children on a good level, around 30 million adequately trained teachers would be required. Given the state of education in the developing world, we would need anywhere from 5 million to 15 million new teachers and retrain between 10 and 25 million practicing teachers. If we are in a hurry, we would have to train them in 3 years for a 3 year teacher training program, that would make 3-9 million new teachers a year. World-wide. This training would require another 100,000-300,000 trainers for the new teachers. In addition, we would have to retrain existing teachers, but let us ignore that for now.

Round numbers:

5-15 million new teachers: Recruit, Train, Deploy

15-25 million teachers: Retrain

100,000-300,000 trainers for these teachers

For comparison, if we would supply these 900 million children with OLPC laptops for 5 years continuously, this would cost around \$40B a year, worldwide. (200 million laptops a year at \$200)

I can write a small encyclopedia with all the objections to spending \$40B/year on education. However, one argument that is conspicuous by its absence is the objection that it cannot be done. Because we all know that it is actually possible to produce and distribute 200 million laptops per year. It costs money, but it can be done. This is technology, and technology can be done.

I like the idea of supplying every child with a well trained teacher in a class with or without technology. My sole objection is, it cannot be done.

The main question that has to be answered first is why there are not enough teachers in the world. It is not that training teachers is an unknown art. Teachers have been trained for centuries now. It is the question why are we short of 5 million or more teachers worldwide. We are all very well to step in front of politicians and tell them they should rather invest in education than in technology. It is a different thing to tell them they should double the number of teachers and classrooms and increase their wages to levels that are competitive to those paid in the private commerce and industry.

It is not for a lack of trying. Ever since development aid became into existence some time after WWII, it has been known that more teachers are needed. But somehow, these developing countries have been unable to supply them. There are many reasons for this shortage: underfunding, bad working conditions, labor migration away from rural areas, competition from other employers, low social status, bad organization etc. These are social problems that we know that social problems are the hard problems. And there are no plans on how to solve these very hard problems.

So, that is why I think the plan "invest in teachers, not technology" is bound to fail. There is simply no known policy that can solve the problems that plague teacher recruitment and training in less than a generation, if they can be solved at all. Trying to recruit and train millions of new teachers is simply going to fail. Any attempt to just throw money at the problem will just as badly as all the other cases where a solution was dropped on these developing countries.

By throwing out technological help in education, and proposing a solution that has

in the last half century, we end up with no solution. This would mean a new generation of children that lose a chance to get educated and become economically productive.

In short, if we simply repeat what failed in the past, there is not reason to assume it will work now. The alternative?

Try to improve the educational systems as they are now and make life easier for teachers and students. Anything that allows the teachers to spend more time to teach and children more time on learning will help.

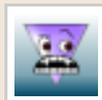


**Kentaro Toyama**

January 7, 2011

Some cost comparison. In India, publicly funded teachers typically earn \$200 per month and that's often considered among the best jobs in the community, because it pays well. That comes to \$2400 per teacher per year, or \$7200 over three years. It would be the same to provide a class of 36 students with \$200 laptops that last 3 years.

Of course, many classrooms in India have many more than 36 students; even at that point, the question we should ask is, if we can't even provide a teacher for 36 students, shouldn't we do that first, before distributing laptops?



**robvanson**

January 9, 2011

All very true. But my point was that if \$200/month is unable to entice enough young people to become a teacher in a rural village now, how are the Indian government going to increase the number of teachers severalfold?

My comment was not about the costs of training new teachers, but how to recruit them where all earlier attempts have failed?

Looking at India, things seem especially bleak:

>>>>>>>>

India has one of the lowest teacher-student ratios: Expert

<http://timesofindia.indiatimes.com/india/India-ha...>

"India has one of the lowest ratio of teachers. In the US, it's 3,200 teacher people, in the Caribbean it's 1,500, in the Arab countries it's 800 and in India it's 100 teachers per million people," Sunder said at the summit.'

<<<<<<<<<<<

To get at the level of even the Caribbean, India would have to TRIPPLE the number of teachers. That is, India has to recruit train and deploy almost a million new teachers.

I have yet to see some thoughts about how they would be able to do that. Before I would think of what it would cost to do so. Even if a policy would be implemented and money could be budgeted, it could take a decade or (much) more to get the educational system up to a par to that of the Caribbean. What should they do for the children entering school in the intervening years?



**robvanson**

January 9, 2011

My point here is not the cost of training new teachers, but the fact that it v recruit more teachers.

If \$200/month is not enough to entice young people to work as a teacher i village, how can the Indian government increase the number severalfold?

Especially in India the outlook seems bleak:

India has one of the lowest teacher-student ratios: Expert

<http://timesofindia.indiatimes.com/india/India-ha...>

"India has one of the lowest ratio of teachers. In the US, it's 3,200 teachers people, in the Caribbean it's 1,500, in the Arab countries it's 800 and in In teachers per million people,"

If India would try to get the number of teachers to a level of even the Carib have to TRIPLE the number of teachers. That would mean it would have to and deploy almost a million new teachers.

It is not the cost I am worried about, but the shear scale of the task. I have thoughts about how such a thing could be achieved.

And even if a policy was formulated and a budget allocated, it could still ta (much) more before the schools in India were at the level of the Caribbean

What should be done for the children that enter and leave school in the m That would be half a generation or more.



**JoG**

January 7, 2011

Why is there no mention at all of the research and findings of Sugata Mitra which l theory of 'Self-Organized Learning Environments' ? His findings point to the use o technology by groups of children, one (1) computer per four (4) children with broa internet access and an 'granny' for the support / motivation. He is convinced that educator's most important job is to ask the right questions. Students will figure ou

-> <http://opensource.com/education/10/12/keynote-twi...>

-> <http://sugatam.wikispaces.com/>

-> [http://en.wikipedia.org/wiki/Sugata\\_Mitra](http://en.wikipedia.org/wiki/Sugata_Mitra)



**Kentaro Toyama**

January 7, 2011

Thanks for the comment. I know Sugata Mitra (he visited my group in 2005 with the technology-for-development research group in Bangalore), and his Hole-in-the-wall was an interesting experiment.

I think his comment points to one terrific way to accomplish education. But, do not underestimate what it takes "to ask the right questions," with the right tone and pacing. A good "granny" in this context would necessarily be a great teacher, and be able to elicit great education without a computer, as well.

With respect to 1 computer per 4 children, I refer you to the cost comment in the immediately above. This is simply not a cost-effective way to spend what are already tight budgets.



**Ron Canuel**

January 7, 2011

I read with interest this article posted by Dr. Toyama and listened to his presentation recently.

I was then and remain surprised by the total absence for the consideration of the students' voice in this discussion. At the Canadian Education Association, we have been studying the intellectual engagement of students (over 60,000), coming from a broad range of schools. Our findings of this research indicate that the levels of intellectual engagement of students are low, yet at the same time, these very same students are demonstrating high achievement on tests. We have advocated that the inclusion of the students' voice can play an important role in the design and elaboration of effective learning/teaching strategies and approaches.

Are we listening? Are we even interested to hear what students have to say about teaching in the classroom? Or will we simply dismiss them and tell them that "we" know better? Will the continuance of traditional approaches will serve them well? Does intellectual engagement matter or is it simply more important to do well on tests that measure common skills (21st century)? Will we accept that learning can actually be fun? Can it be different?

A closer look at research on dropouts indicates an increasing desire to have curriculum, methodologies and tools (yes, even including ICT) be relevant and meaningful. Do not ignore what they are saying and say, sorry "we" know what is good for you?

Any tool poorly used in the classroom can and will create problems/issues and that includes ICT technology, textbooks, chalk, blackboards, pencils and paper. I have seen countless teachers have to struggle with poorly designed textbooks or out of date materials and I have read any articles calling for the exclusion of textbooks from classrooms, or suggest a gradual integration and usage.

I also am saddened by the constant inference that the people who are trying to lead the way in rural districts/schools/classrooms are gullible. I have been closely involved in the technology in education context for some time and am more intrigued by how educators HAVE NOT integrated technology into the classroom. The Pro-Technology Rhetoric that you hear emanates from a minority (and many tech suppliers). If you ask Ed Tech. associations, they have been openly calling for more technology into the classroom, they too will admit that it has really "happened". The National School Board Association (US) just hosted their 10th Annual Technology and Learning conference. So it might provide some comfort in knowing

integration of technology is being given very serious consideration and thought. I use the term that I use when talking about change in education: "Impressive but not Convincing"

In closing, you have clearly spent much time and energy on this article and thank you. However I found few new insights to add. Other than stating that there are no shortcuts in education, (and having worked as a public educator for over 35 years), we all know that technology never replaces a good teacher. But in these times, it behooves all of us involved in education to be more considerate of how students want to learn, listening to them and maybe, just maybe, they can give us clues/insights on how to further enhance the quality of education in classrooms around the world. I suspect that they will mention ICT. The students voice: Will we?



**Kentaro Toyama**

January 15, 2011

Thanks for your comments, Ron!

With respect to the child's perspective, it's not likely to be resolved by abstract arguments but... The ideal adult-child interaction is difficult to specify in a few words. It shouldn't be that the child is coerced to do what the parents want all the time and to assume that the child's natural inclinations always make sense is also problematic. Children want to eat a lot of sugar, and many want to play violent video games. Good, non-coercive supervision (which takes into account the child's voice) is necessary — and, though not always claimed, is most critical. (cont'd...)



**Kentaro Toyama**

January 15, 2011

(cont'd) As for the gullibility of educational leaders, I apologize if that was implied. I'm glad to see how many developing countries declined any national OLPC programs despite Negroponte's wooing. I do believe that many ministers of education are temporarily susceptible to national PC programs, though, not because they're gullible, but because technology programs are a quick, visible way to claim impact.

I'm glad that we agree that "nothing ever replaces a good teacher"... but it's exactly that's not a sentiment shared by everyone (see other comments!), that I continue to question.



**Colin McElwee**

January 7, 2011

What a bizarre debate!

Within the ICT development community it seems we work in an area that assumes a problem (education) and assumes a solution (computers) and go right ahead and throw a possible solution at the need and we are then surprised that it doesn't work. Do that anywhere in the world and the chances are it won't work, but unfortunately many talented professionals in this community and leave basic business practice aside.

To be clear: Any developed world company analyses the market, the competition, the distribution systems, the gatekeepers, the clients, the customers, the people, their needs, and then they develop a solution.

and fears, identifies their needs and if they are really smart also their unexpressed needs before they test their “solution”. They then adapt their solution to real need, not an unexpressed need that emerges only after a soft launch. They then keep on adapting to emerging needs. They do this not only by country, but by each respective market. They are obsessed about client and customer experience. Ongoing.

Companies, governments and NGO’s that don’t perform this basic business practice have their efforts end in tears.

Sorry but that is really basic. And we all know it, but seemingly choose to believe that the world doesn’t need such investment of time and effort. Kentaro correctly refers to gatekeepers and implicitly to the importance of gatekeepers, but concludes that technology does not belong in the classroom. Great analysis but a provocative and erroneous conclusion that leaves a feeling it is technology that is the problem. It is not. The problem is often how we approached the challenge.

There are technologies that may work for teachers and not for students and vice versa for both or for neither. But has anyone taken the time to not only ask students and teachers what they think they need but also to identify through observation what they need? And then test it with no expectations of success or failure, but simply to learn?

At worldreader.org we are trying to do exactly that. We may be wrong or we may be right. E-readers and their capacity to dovetail into an education system without significantly disrupting the “system” itself. E-readers have the advantage that they carry books, a familiar tool to many teachers and students alike. We are not so worried about the poorest or the poorest rather about the enormous middle segment of teachers and students that would exist if they could have access to books to further develop their basic literacy and critical thinking (a common assumption). This we believe would create the critical mass of people that could transform societies. We are pretty sure in our pilots we will be somewhere between success and failure. We will adapt the offering (technology, content or approach to market) as we learn from that with results from other markets and other segments.

By the way, the education system is basically a distribution mechanism that we believe is the utility of reading. The real learning as some of you have commented in posts was when the students take these devices home and read content they have chosen for themselves. It could be it football, poetry, African literature, politics, romance, history or creativity. The teacher goes for the teacher who will be able to enjoy reading about his own subject or about his/her fancy. For many of us, the simple act of kids of choosing and reading a content of 80,000 uniquely worded books (and extracting meaning, no mean feat), has changed and has allowed us to become individuals who can critically participate in the interconnected globality that we live in. Given increasing 3G connectivity we can now give that same opportunity to many others.

The article is a wonderful provocation to the ICT development community (and we are so I congratulate Kentaro for so eloquently laying it out.



**Kentaro Toyama**

January 15, 2011

Thanks, Colin. I agree that if you're going to use technology in the classroom, you need to bring to it all of the practices of running a good organization. But, I would flip that and say that (at least for schools), if there isn't a good organization in place, then a technology-led program won't save the day, any more than a new-PC-and-server datacenter program will turn around an unprofitable company.

I know a bit about Worldreader from your co-founder David Risher. I have to see the kind of program that I would normally discourage (for opportunity cost reasons, I think your team has been going about things in a careful and impactful way so long as you have human intent and capacity!). My primary hope is that that care continues, and you come upon the situation where Minister X decides he wants to do Worldreader for a million of his students, that the decision will really be made based on the well-justified superior cost-benefit of the program for education, and not because N million dollars is a big number.



**@markwarschauer**

January 7, 2011

I don't have time to comment on this long and thoughtful essay now, but I would like to comment on the way that I am quoted. Kentaro always quotes me accurately, but he chooses (appropriate for his message) to emphasize one aspect of the points I make. For example, with his point that technology in and of itself will not reform education and can serve to increase inequality. However, I also think that, certainly in a U.S. context, and probably in other developed countries that can afford it, well-designed educational programs incorporating technology can be a very strong desirable—and, if designed well, can help overcome inequality. Here, for example, in an evaluation we've done recently of a California school district program using netbook software that increased test scores for all, but even more for English learners and low-income learners: <http://bit.ly/fx0cub>



**juanslayton**

January 8, 2011

I, too, want time to think over a longer comment on this essay, which will be forthcoming. But I did take a look at the Saugus study, and I'd like to know a bit more about it. In particular, my first impression is that the reported hours of netbook use seems pretty high. Did these students have any preparatory skills, particularly keyboarding? Are they doing composition by hunt and peck? That can really slow you down. OT, but maybe Wayan will let it through. I want to thank you for your recent reply to my inquiry about Gnu Eclectic Reader. (UCI's spam filter won't let my e-mails through for some reason.)  
John Slayton



**Kentaro Toyama**

January 15, 2011

Thanks, Mark — I do my best not to misrepresent you. (I do mention some of the results you're finding in the United States in Point 5 above, of the different ways that computers can contribute to schools.) The critical precondition is that the schools be well-run to begin with... a point I believe you also agree with. Technology requires pedagogical intent and capacity.



<http://www.cultureandrecreation.gov.au/articles/s...>

[http://www.hreoc.gov.au/human\\_rights/rural\\_educat...](http://www.hreoc.gov.au/human_rights/rural_educat...)

Here we have a situation as is classical in the developing world. There are children to be educated. They lived too isolated to make visiting a real school feasible. So, schools were delivered over the air by two-way radio. Note that these schools of the air serviced small groups of children (140 for Alice Springs).

This was about twice as expensive as conventional schooling. I have not been able to see the results in terms of academic performance of the students.

I believe the (implied) message that technology invariably fails to deliver education where teachers are scarce or poorly trained must be dismissed. It is indeed possible to extend the reach of education using technology.



**Kentaro Toyama**

January 15, 2011

This is a nice example of technology working well, but it's exactly in hyping about this as a "technology project" that the problems arise. I have never visited this school, so I can't say from firsthand experience, but even reading the links you provide, it's clear that there are lots of teachers (14+5 for 140 students, or better than a 1 to ten ratio!); the teachers are good; and the administration of the system is good, thanks to a combination of good teachers, parents, tutors, a working correspondence system, and what I'm sure is good school administration. It's also interesting that the teachers make weekly visits to all the schools to see the students — it's not a lot, but a good teacher can make a lot of use of that time to check on progress, motivate and encourage.

If the lesson you drew from this example was that airing a 30-minute radio show over the air was enough to educate people without a real school, that would be a true error.



**Scott Kipp**

January 8, 2011

I could not agree more with Rob Van Son and Doug Houlton's above comments on how myopic the definition of "technology in education" is presented in this article. It reminded me of Kevin Kelly's recent tome "What Technology Wants."

(<http://www.kk.org/books/what-technology-wants.php>). If there is to be a proper, comprehensive definition of "technologies" and an equally thorough review of the acquisition of education throughout history, I am convinced that the conclusion is inescapable. Your statement, "Technology has never fixed a broken educational system" is thus a bit misleading. Are you speaking to the history of all technologies in all educational systems?

I do appreciate the nod this article makes to the importance of holistic approaches to education. Integration, however, I cannot help but marvel in discomfort at this apparent need to set benchmarks whereby "experts" descend to qualitatively (and thus subjectively) determine if a given education system is "ready" to use the tools of the well-off. I believe Maria Montessori, above, referred to this "paternalism" as well.

This article did make me think of a catalytic benefit of ICT4E that we've seen ment before. If interventions in the classroom (or in the telecenters you visited in your B article) prove ineffective in showing positive results on the (sometimes narrow) m for measurement, and if the analysis concludes that improved teaching is needed, benefit resulting from the intervention itself? In other words, had the school conti money into its existing teacher training prior to the intervention, they might not h articulated what about the training process was failing. The intervention can serve these inefficiencies, much like biologists use frogs to measure air quality.

I kept waiting to read mention of parents in your article. Most schools, even poorl ones, depend on parental approval for survival. This is ever-more true in India's lo schools, as you probably know. If parents are on board with an ICT4E intervention well might put pressure on their child's school to catch up on the times, without l on the development of critical thinking or analytical skills. It is a functionalist and for ICT4E, and the consumers of education are voting for this all over the world. Ar wrong? Is it that dichotomous?

Lastly, I'm not sure I understood your comparison with textbooks. I have read sim before, and the reply I come to: netbooks in recent ICT4E interventions typically c encyclopedias and, increasingly, an eGranary (or similar) e-library. The sheer mag available needs to be more accurately described in your comparison, as it can be a consideration in the TCO.



**Kentaro Toyama**

January 15, 2011

Thanks for your comments, Scott.

I stand by the claim that "Technology has never fixed a broken educational sys doesn't mean that technology has never contributed positive things to educat mean that when those positive things happened, they were undergirded by sc (usually, someone with power and money) positive intent and capacity. It als you have a failing educational system, technology-led initiatives are pointless the underlying human/institutional system.

As to paternalism, I believe development is inherently paternalistic, and the b is to mitigate the negative aspects of paternalism. But, in this instance, the int "we, who are rich, know what is better for you, who are poor," but rather, "son have studied the impact of technology in education think that technology wil you have other conditions in place first." I have seen some NGOs running grea also making good use of computers — that's great!

(cont'd)



**Scott Kipp**

January 18, 2011

Thanks. Regarding the pervasiveness of paternalism in development disc wholeheartedly. At the root of it, that is why I take issue with your claim th educational systems do not possess the capacity or informed intent suffici from the scalar multiplier you mentioned as a possible positive outcome.

If I should be more specific, I would say that I think it is a fundamental mi

dangerous oversimplification to classify any educational system as either "fixed." I understand you were likely meaning to speak in general terms, but too much of No Child Left Behind to be left unaddressed. Namely, I believe an environment of educational regulation built on such a linear projection will hinder innovation for everything from teacher training to definitions of functional literacy. We are far more complex than that, and the immense diversity and idiosyncrasies of our education systems worldwide are the best living and most interesting examples.

If we then take your claim at face value, it must follow that no teacher-training or certification program has never (fully) fixed an education system, because the teachers receiving the training are themselves in constant flux. Teacher training programs require persistent refinement and contextualization, as do ICT4E interventions, and educational systems themselves. I mostly agree that nothing replaces a good teacher. Nothing, that is, except for a better teacher.



**Kentaro Toyama**

January 15, 2011

(cont'd)

I find it a bit strange to suggest that ICT4E efforts are good if they lead to a recognition that improved teaching is needed. Every school could improve their teaching, and there are many more direct ways to find out how. I doubt that putting computers in schools is primarily to discover that Teacher X can't manage his students, that Teacher Y is absent too much of the time, or that Teacher Z should be more liberal with praise.

Parents are absolutely important. I applaud programs like Peru's APAFA, which legally enforced PTA. What I would say is that to the extent that parents are involved in their children's schools, the better, and the more likely that the school itself will do well. But, as is all too often the case in many developing countries, as well as poor communities in rich countries — see, for example, Annette Lareau's work), and the school is failing, that's not a problem that technology will fix.



**Scott Kipp**

January 18, 2011

I'm glad you mentioned Peru's APAFA. Local APAFAs' inputs are being taken into account in the evaluation of OLPC in that country, and I was pleased to see that the initial data indicate that teachers in treatment schools reported improved relations with parents (see the preliminary IDB report).

Although not specifically mentioned in the report, my hunch is that the OLPC deployment significantly increased the face time between teachers and parents. Few would claim that an ICT4E intervention would be able to completely solve the problem of incompetent teachers. And, as I said above, every teacher can improve. But the intervention's role as a catalyst in improving stakeholder relations in educational advancement is rarely addressed. I felt it was missing from the report, even on the mentions you made of successful ICT4E interventions.



**Scott Kipp**

January 21, 2011

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**Kentaro Toyama**

January 15, 2011

I agree that the flexibility and potential content available through digital means are great questions. But, it's also worth considering that you could put together a very nice library of books for the cost of a laptop, and certainly for 30 laptops. All opportunity costs get down to the nitty-gritty of actual costs, so it's not easy to say X laptops equals a book library. But, I'd suggest that for a primary school library, if you had to choose between a few laptops pre-loaded with \*all\* the books in print in the world today and 500 books, it's not immediately clear which would be better. It's certainly not just a matter of adding up the total cost of every published book. (I emphasize "primary school" because the answer might change for a university reading room. And, for secondary school, it's a very tough call.)



**Colin McElwee**

January 8, 2011

Within the ICT development community it seems we work in an area that assumes a solution (education) and assumes a solution (computers) and go right ahead and throw a solution at the need and we are then surprised that it doesn't work. Do that anywhere in the world and the chances are it won't work, but unfortunately many talented professionals in this community and leave basic business practice aside.

To be clear: Any developed world company analyses the market, the competition, the distribution systems, the gatekeepers, the clients, the customers, the people, their needs and fears, identifies their needs and if they are really smart also their unexpressed needs before they test their "solution". They then adapt their solution to real need, or to an unexpressed need that emerges only after a soft launch. They then keep on adapting to emerging needs. They do this not only by country, but by each respective market. They are obsessed about client and customer experience. Ongoing.

Companies, governments and NGO's that don't perform this basic business practice have their efforts end in tears.

Sorry but that is really basic. And we all know it, but seemingly choose to believe the world doesn't need such investment of time and effort. Kentaro correctly refers to the importance of gatekeepers, but concludes that technology does not belong in the classroom. Great analysis but a provocative and erroneous conclusion that leaves the feeling it is technology that is the problem. It is not. The problem is often how we approached the challenge.

There are technologies that may work for teachers and not for students and vice versa for both or for neither. But has anyone taken the time to not only ask students and teachers what they think they need but also to identify through observation what they need? And then test it with no expectations of success or failure, but simply to learn?

At worldreader.org we are trying to do exactly that. We may be wrong or we may be right. E-readers and their capacity to dovetail into an education system without significantly disrupting the "system" itself. E-readers have the advantage that they carry books, a familiar tool to many teachers and students alike. We are not so worried about the poorest or the most rural rather about the enormous middle segment of teachers and students that would exist if they could have access to books to further develop their basic literacy and critical thinking skills (a common assumption). This we believe would create the critical mass of people that could transform societies. We are pretty sure in our pilots we will be somewhere between success and failure. We will adapt the offering (technology and content) as we learn and contrast that with what we see from other markets and other segments.

By the way, the education system is basically a distribution mechanism that we believe is the utility of reading. The real learning as some of you have commented in posts was when the students take these devices home and read content they have chosen for themselves. It can be football, poetry, African literature, politics, romance, history or creativity. The real learning goes for the teacher who will be able to enjoy reading about his own subject or about his/her fancy. For many of us, the simple act of kids choosing and reading a content from a library of 80,000 uniquely worded books (and extracting meaning, no mean feat), has changed. It has allowed us to become individuals who can critically participate in the interconnected globality that we live in. Given increasing 3G connectivity we can now give that same opportunity to many others.

The article is a wonderful provocation to the ICT development community (and we all) so I congratulate Kentaro for so eloquently laying it out.



**webrunus**

January 8, 2011

Based on my 5 year long experience in Burundi, setting up computer labs in private high schools and training teachers to use them I think the following:

1. the school mandate is to train upright educated citizens, able to thrive in the environment they will find once out of school. It is hard to think that this environment will not embed computers of some form and the internet as daily tools for working and living. It is already the case in urban areas and it's increasingly so even in rural areas. Therefore teachers and students with access to computers and the internet can be well considered part of the institutional mandate of a school, especially when this access will be not otherwise.
2. Moreover, when the student-to-PC ratio is high, they tend to use them collaboratively. There's a lot of peer learning going on, if they are given the chance to communicate. To a certain extent, this argument goes against the 1 PC – 1 pupil approach, as having to work in

the same PC, vicarious learning might occur.

Summarising: I believe that developing a basic familiarity with such devices, even if not directed by teachers, has in itself an educational value, as students and teachers have the opportunity to use the PC actually DO things with it. I've seen Brunundian teachers use Encarta to prepare their lectures, as they don't have textbooks available, just the ones copied at the University -the good ones – which were their copy of their professor's course. I've seen teachers building their own textbook with their students "distilling" wikipedia. I've seen teachers becoming addicted to the French educational TV show "Le sorcier" very much the same way I was fascinated by David Attenborough's "Life on Earth" when I was a kid. This is learning made possible through technology and not possible otherwise in that context. "This is not formal learning" Fair enough. "This is not sustained motivation" arguable: I think it entices curiosity. "This doesn't develop any critical thinking, communication and creativity" It doesn't automatically, but it allows for it in many contexts. Certainly, I don't think this sort of learning is neglectable and can be dismissed as a "novelty effect". This might be the case in so-called developed countries where people can be tinkering with their computer at home, at work, everywhere, not where computers and schools are the only place it can be done. It's like students going to school at night where there's a neon light to study whereas at home they don't have electricity.  
(continues...)



**webrunus**

January 8, 2011

Having said that, nobody will think that PCs alone can replace teachers, or as Arthur Schopenhauer once said "a teacher that can be replaced by a computer, should be". Likewise, I think I agree that "at the end of the day it is the human being that makes the music", aka that bad teachers will not be fixed by technology.

3. I reckon that one cause of failure in ICT4E projects that you don't consider in your model is the lack of ownership that is very common in many such projects where PCs are "provided" to the schools and that's it, job's done. I think there is an intermediate link which is often overlooked in such projects which is the necessary training to service the technological infrastructure, so that there is someone appointed to be responsible for it and who is well trained enough to feel comfortable with the technology s/he has to administer and to whom to ask for help if needed. The most common comment I heard from the people in system administration – mostly completely PC illiterate before – was that they had a fear of technology, they would dare opening the case and touching inside the machine, installing a new software and play around with it. To build this confidence in someone responsible for the maintenance is crucial and this is a weak link that lies inbetween the technicians, pedagogists and taps onto the administrative level. Without it you don't even get to the point where you can devote energies in training the rest of the teachers to integrate the use of computers in the curriculum of subjects other than computer literacy in itself. Should we want to do that? Because I believe it can help teachers in their noble aim of "infecting" students with their passion for learning (see <http://www.teachers.tv> for examples).

4. Opportunity costs. This is the trickiest one. Should we be investing more in developing regular textbooks, pedagogical training and higher salaries for teachers and less in developing fragile technology?

Probably yes, but I did witness a few cases in which the school computer lab was used as a cybercafé, a computer training center, or rented to NGOs on week-ends in order to generate income to the school for its own sustainability and even as an extra flux of money. If a savvy administration is in place, technology is not necessarily just a cost but can generate value.

revenues as well. I do admit though, that these were not the majority of cases and a good balance between serving the school population and setting up a service for the community to earn money is not an easy task and requires a wise leadership. Surely something different from the OLPC, 1-to-1 approach.

5. All in all, although I strongly believe that people – teachers AND students – and technology should be always our focus, I do obviously agree teachers' training is key to education, but I don't agree that we should keep away from technology as it has probably more harm than good unless the school is good already. I think an effective use of technology is possible even in deprived contexts, provided that we take into account the whole context. We address the implementation of technology as an holistic process, without forcing it, but patiently "going with the flow": gradually empowering local pioneer opinion leaders and existing opinion leaders to become pioneers. Such sensitivity is hard to get with the current aid system, especially in large scale projects, as the mainstream approach tends to be standardised, top-down and too tightly time-bounded, not allowing for a flexible improvisation.

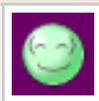


**Kentaro Toyama**

January 15, 2011

Thanks, webrunus, for a very carefully thought out response! On the whole, I agree with you. My claim has never been that technology cannot be useful, but that, (1) technology cannot fix broken educational systems, and (2) when technology works positively, it is the competent, well-intentioned people behind it.

Individual, positive examples of technology working are terrific, but if the conclusion of such projects is that we should therefore spread the technology to improve the situation in other contexts, then that's an overgeneralization. For every child being inspired by Attenborough, there are hundreds watching cartoons. It's not TV that's providing the benefit (though it enables it), it's whomever has decided to broadcast educational content and more importantly, it's policy (in the family or in the government) that limits entertainment during child TV-viewing hours. As you put it, wise leadership is required from the top, and from the bottom, wise aspiration. Without the wise leadership, technology doesn't get used well. With the wisdom, everything works well, including technology. So, where should we put our efforts?



**Zulfi Erken**

January 8, 2011

Hi I think we must separate two things.

First you are right when you say: technology is unable to substitute for good teaching, each teaching is not only about knowledge, but also about educating.

Second, good teachers are necessary to use technology. I mean my observations at high performing teachers shows that they are more tech savvy and use technology better than low performing teachers. Moreover, low performing teachers do not use the technology efficiently.

I believe that technology is like a sharpened knife while old teaching methods were blunt knives. High performing teachers were sharpening their knives as much as possible while low performing teachers were using them directly. Now teachers are teaching very well while low performing teachers were using directly. Now teachers

sharpened knives. But still we need teachers who can use sharpened knives correc



**Kentaro Toyama**

January 15, 2011

I agree. And, while sharpened knives are great tools, if you had to choose between a chef with a bad knife and a poor chef with a great knife, you'd want to choose the



**Ian Thompson**

January 9, 2011

If I was to condense this long and thoughtful article to a twitter post ( and I am not very wise thing to do) I would say that you have successfully proven that the Education system is very poor at adopting new technologies (and even to change at all). The thrust of your argument is that we should blame the tool when it is used poorly. An interesting conclusion. In other public sector has successfully adopted technology to improve services and reduce operational costs. Why is it that Education struggles so much to do this? Another useful but totally absent discussion is an evaluation of alternative approaches to solving the education problem facing the developing world. I am sure we can all write equally good reasons why it is impossible to improve the situation at all. (See post by Robvar on why it is impossible to provide enough trained teachers) A more useful approach would be to ask if it is possible and then desirable for ICTs to be used? I believe a number of education researchers have concluded that it is certainly worth trying, perhaps not as the only solution, but as a total solution. Of course, we need toilets at schools and we need healthy teachers and students, but surely we are not saying we can only do one thing at a time. I note your concern on the TCO for ICTs. Have you done the sums on the TCO of having uneducated children? we can see if the cost of ICTs, or any other improvement proposal, is acceptable. It is not that the current education system is not working for developed countries. What would be your proposals to fix that.



**Kentaro Toyama**

January 15, 2011

Thanks, Ian, for bringing out a point that other commenters have hinted at in but haven't stated as clearly as you: "that we should blame the tool when it is used

No, I'm not blaming technology! I'm blaming people and institutions. And, that's where they're where the turnaround has to start. Using technology to fix an education system is like buying a better scalpel for a quack. It's people who ultimately decide whether technology has positive or negative impact. It just so happens in education, that to get the people part right, it obviates much of technology's supposed value.

As for TCOs, what I mean is that ICT4E must be compared against TCOs of other investments in education, many of which have proven impact on learning. I do not mean that we should let uneducated children go uneducated.

I encourage readers to look at this paper by Charles Sabel et al., on how the Finnish education system runs (and how it required a deliberate transformation), and on getting small things in administration and teaching right: <http://bit.ly/hRtvb6>



**Matthew Kam**

January 9, 2011

This semester at Carnegie Mellon, I'm teaching an undergrad + graduate level course of technology in learning in the 21st century. (The course will have an emphasis on developing countries since that's one of my research focus.) I'll be using Kentaro's first class this week for an in-class activity, in which students will raise their reaction article in a post-it note activity. I'm sure this activity will generate several excellent that we'll use to motivate the material that I plan to cover in the rest of the semester which is centered around what the science of human learning has to say about the. Before we think about putting technology into the equation, let's first focus on how we actually learn and the conditions — including social — necessary for learning.



**Kentaro Toyama**

January 15, 2011

Thanks, Matt! I would love to hear what your students have to say. And, I'd be happy to have a discussion with them (using ICT in some form to mediate the distance!).



**@jamesbt**

January 20, 2011

Huzzah, Matt! I completely agree w/your last statement. And that kind of thing is what led me to tweet: [When designing an #ICT4D intervention, the fidelity of underlying models/frameworks & assumptions is critical to success.](#)



**juanslayton**

January 10, 2011

Climb into the Wayback Machine and regress with me about 30 years. I am not a teacher, I have two school-aged kids and I serve on the site councils at Philadelphia Elementary High School (Pomona Unified School District). The schools are looking at computer instruction. State of the art is main frames; we visit 3 demonstration installations (in Los Angeles, and Hesperia, if I recall correctly). A proposal is floated to contract for computer instruction at Philadelphia, but there is a catch—it will be paid for by dropping currently employed classroom aides from our school plan.

I talk personally with uptown administrators. It appears they are taken by surprise and not aware of the proposal. The proposal itself subsequently quietly disappears. My current decision makers have weighed the relative merits of machine-time vs. people-time (and the political risks of laying off a bunch of people) and have chosen people-time. I think it's the right choice.

OK, back to the future. It is now 2011. I have retired after 21 years of service in the Philadelphia Elementary district. But I still substitute around the district, so I see a lot of stuff. It appears that classroom aides have dwindled over the years to the point that they are today

insignificant factor in regular classrooms. But computers are everywhere, both in c and in dedicated labs. We know that times have changed. Could it be that they have changed to the point that ma now considered more effective than people-time?

I think not. Something else has happened: Interested groups have created special sources for technology. These sources appear in our district budgets as 'Restricted' restriction can be quite narrow. For example, e-rate monies, a significant source of be used only for internet related projects. Pomona Unified had to be reminded of t to their considerable discomfort. And these restrictions are different from many ot accounts, in that they do not favor particular groups of students or particular need particular instructional tools. (Of course one can argue that textbook funding shar characteristic. That's a whole 'nother discussion.)

The effect is that the competition between technology and other forms of educatio investment is no longer a concern. That competition has not been resolved, mere. Technology money is not competing with books, field trips, instrumental music p The money is there; if we don't spend it, someone else will. Some districts will loo copy their neighbors, others will buy whatever looks good from the usual commer and a few will partner with university graduate schools to attempt rigorous researc money will be spent. If nothing else, one can always send big bucks to a hosting se a fancy web site for the district. We can count on the money to be there, at least un citizenry starts asking questions about the multi-paged phone bills.

Meanwhile, back in the developing countries, things are not so tidy. Technology fi direct competition with other needs and Mr. Toyama's essay underscores the prof public discussion. But it should not be as we see all too often in the media: "Let's y fight, while we cover the story," with everything reduced to visionaries vs. Luddites. Tho actually engaged in educating the next generation are capable of more nuanced an next comment I try to describe from my own experience how one specific applica some of Kentaro's concerns.



**Kentaro Toyama**

January 15, 2011

Thanks, Juan, for some nuanced comments.

I agree that where budgets are ring-fenced for technology, the question then b best to spend that budget. (And, I have written elsewhere about that — all alo making sure to put it in the hands of a competent organization/person, and to the budget should cover technology support — often human — in addition to technology. Corporate IT budgets are never just about hardware; schools need it takes staff to run technology.) But, I suppose, in this article, I'm making the who actually control the budget at the highest levels.



**juanslayton**

January 10, 2011

Climb into the Wayback machine again. This time we're only returning about 20 y

funding sources have not yet arrived. LeGore school has maybe 3 or 4 up-to-date Macintoshes, some of which are gathering dust in the closets. It's a big deal when Cameron manages to pull down a Rierdan grant that gets us two more machines. Meanwhile, I'm experimenting with Commodore 64's. And discovering that there is no magic machine that will enable any significant use of two or three computers in a classroom with 30 students. Computers are tutors, but teachers work with groups. What I need is some way to get simultaneous access to the machine for every student in the class. I look at peripherals and come up with something very similar to the recently posted "One Mouse Per Child" and could fairly call it, "One Keyboard Per Child." Here is the link again to what it ultimately looks like: <http://members.dslextreme.com/users/juanslayton/d...>

I wrote programming for a number of learning activities, but I want to comment on one that was a routine to enable students to check the paper-pencil exercises that they were using in the adopted math text. The computer would present the student with just three questions: 1) "What page?", 2) "What problem?", 3) "What is your answer?" Page and problem numbers would come from the textbook, of course. The answer would come from the computer, and the student would just did on his paper. The machine would tell him if his answer was right or wrong. That's all. Too simple to be useful? Not at all. It turned out to be the most useful application I've ever used. To see why, let's look at a typical instructional situation.

Somewhere in second and third grade, our kids learn procedures to solve subtraction problems requiring borrowing. (OK, that's "regrouping" for you guys who love the opaque terminology of newmath.) Students make all kinds of mistakes in learning this, but the most frequent is probably subtracting the top number from the bottom. So as I review the algorithm in my classroom, I stress that this is one of two things you can never do, and we walk through several example problems on the board. When I think most of them understand it, I assign several problems from the book for practice and then begin walking around to see how they are doing. But allocated time is short, there are 30 of them, and time runs out long before I can check everyone in the room. The first time I can really evaluate their learning is that night at home, when I inevitably discover that some of them did not get it, and persist in taking the top number from the bottom. We'll go to work on that tomorrow, but now with the added handicap that they have spent an entire session practicing doing it wrong. And there is truth in the saying that practice makes permanent, and permanent makes perfect.

But let's replay that scene with the keyboard system. Instructions to the class are:

- 1) Do the first problem on your paper.
- 2) Check your answer on the computer.
- 3) If your answer is wrong do NOT go on to the next problem.
- 4) If you can't figure out what you did wrong, raise your hand and ask for help.

What effect does this have on student behavior? Well for a few, no effect at all. These are the present daydreamers who didn't hear my instructions.

But for those who were listening, the effect is dramatic. First, a good percentage of the students who make mistakes find the problems themselves and go on to the next problem without my help. This leaves me free to concentrate on those who really need more help. Second, the system completely prevents practicing an erroneous algorithm. Third, for many students, immediate feedback is a powerful motivator. They don't want to wait until tomorrow to find out if they are doing it right. If I neglect to fire up the computer, as I sometimes do, they come to my attention right away. Fourth, the system helps enable what I consider a preferred method of genuinely individualized instruction. Every student in the class can be working on a different page in the book, and by the end of the school year, they are in fact pretty much self-directed. I say "helps" enable because the computer by itself is not enough. I did individualize instruction in most of my 21 years in regular classrooms, and I found that the presence of the ins-

was pretty much a necessity to make it work.

My conclusion is that I very largely agree with what Kentaro is saying. Technology shortcut that can substitute for personal guidance. Getting the personnel on static first priority. Where that is achieved, technology is useful, but must justify itself as possible expenditures. In the example just discussed, it was useful because: 1) It was 2) It was a one-per-student application, 3) It was a powerful motivator, and 4) It helped enable best practices.



**Kentaro Toyama**

January 15, 2011

I appreciate this description of your experience. I think it nicely illustrates how technology can amplify the effect of a single, good teacher, but that it in no way could have replaced him for him.

Many people would take this example and say, here's Juan with teaching capacity  $X$ , and technology, and capacity increases to  $X + Y = Z$ . So, let's take technology, spread it everywhere, and assume that we'll see benefit  $Y$  everywhere.

What I'm claiming is that technology's impact is amplificatory. Juan is  $X$ . Including technology and it leads to the same  $Z$ , but not  $Z = X+Y$ , but  $Z = X * Z/X$ . Now, if you add technology to a school with teaching capacity 0. You then end up with  $0 * Z/X$ .

Extremely simplified, but that is roughly what I mean when I say technology's impact is multiplicative, not additive.



**BEBeltran**

January 11, 2011

Thank you Kentaro Toyama for a thought-provoking article. You hit a nerve with many (and evidently many others). I have been following this on-line dialogue and while I see the potential in the appropriate use of ICTs, I can't help but to compare the observations I have shared about their experiences implementing ICTs in developing countries with the challenges I see where I teach. I teach elementary school in a highly affluent school where every classroom is equipped with computers in every classroom, computer lab at each school site, Smartboards, laptops, document cameras – the works. Additionally, teachers and support staff are well educated and trained. In short, it is the ideal environment for thriving ICTs, and yet they are under utilized in many classrooms. How does all this relate to the discussion at hand? What I have seen even in the best of circumstances: ICTs are costly to operate, difficult to maintain, investments made without a thorough needs assessment and teacher buy-in result in wasted or not fully utilized resources, and technology alone is limited in its ability to elicit higher order thinking from students (a key point that is glossed over in so many of these conversations). So the real questions, I think, relate to how various ICTs are implemented and how they are utilized. What specific learning objectives are we hoping to realize with these tools? Which tools are the most cost-effective, appropriate solutions for a given community? How are the learning objectives evaluated? While my teaching context differs vastly from those found in developing communities, I imagine the very challenges we face here must be magnified in settings with weak infrastructure and lack resources.



**robvanson**

January 11, 2011

Isn't the whole problem not that the focus of all the "interventions" is on "Education in the classroom"?

Like my other comment on public libraries and literacy, I would state that schools should teach face-to-face in the classroom, and children should use other resources, like books or the Internet and social media, outside the classroom.

This does look a lot like the financial focus in many developing world countries on expensive hospital treatment, including intensive care units. In the meantime, the things people in the villages really need are oral rehydration therapy and vaccination, which are not used in intensive care units.



**Kentaro Toyama**

January 15, 2011

Thanks, BEBeltran, for an honest, self-aware response. I find, in a paradoxical way, that exactly those teachers and administrators who have the capacity to maintain some skeletal use of technology, who end up wielding it most effectively — probably because their focus is on education, and not on technology usage.

I agree with all of the questions you're asking at the end. Those are the right ones. And you're absolutely right that the challenges you see in your wealthy, highly capitalized system are even greater in poorer environments.



**@Mokurai**

January 11, 2011

Rather than complain, it would be a better use of our time and energy to look at solutions.

Yes, teachers are critical to the success of ICT4E. What training do teachers in various countries receive, either in teachers' colleges or on the job? What can we give them? What resources are made available? Do teachers have to rework their entire curriculum themselves in order to integrate computers into the classroom, or can we rewrite the textbooks and provide sample lesson plans for them?

These questions have obvious answers. Appropriate training and support is certainly needed. Textbooks can be put into electronic form and licensed for free distribution. We can apply software to e-learning materials, not just creating static PDFs of existing materials. The obvious is how it will be provided. Who will take the initiative in organizing and funding? Who will do the research, the development, the evaluation? Can experience feed back into continuous improvement? Where will the political will come from (meaning build support, particularly among voting parents)? I can make some suggestions, and then you can ask those who know far more about one aspect or another of the problem.

How can we recruit teachers for villages? That's a harder one. Not from the cities, as you comment notes. Greg Mortenson (Three Cups of Tea, Stones into Schools) suggests training and growing them on the spot. From every village where you build a school, send one girl

though not always) who wants to be a teacher to college. There is more to it than that could get into details in a different discussion.

The pioneers of computers in education, and of educational innovation in general, are trying to provide many of the needed materials as soon as funding is available and we can get appropriate license agreements. This includes organizations and people such as

Alan Kay, inventor of Smalltalk, with Squeak and Etoys

Doug Engelbart, pioneer of Enhancing Collective Intelligence through shared computing

Idit Parel at Seymour Papert's education lab at MIT

Creative Commons ccLearn

Walter Bender, Sugar Labs

Nicholas Negroponte, One Laptop Per Child

Open Learning Exchange

Teachers Without Borders

and many more. Much of what is currently available is catalogued at

<http://www.librarianchick.com/>

We have field experience in supporting and training teachers in places like Nepal and India where startling advances have been made on one part or another of what is needed to overcome major teaching and learning deficits in entire schools. When we decide to bring the best practices of all of these projects together, we will have much more to offer our billion and many millions of teachers than has so far been dreamed of.

Who would rather teach teachers how to teach children to make candles, rather than to bring out of the darkness?



**Kentaro Toyama**

January 15, 2011

Thanks, @Mokurai, for leading a call to action! I would just say that it can save a lot of effort, and resources, to make sure we know we're headed in the right direction, before we go off into the wilderness. I would argue that some of the organizations you cite have diverted educational budgets away from proven interventions and into unproven technological interventions, which hurts the cause more than it helps.

Why assume that technology must be a part of a good education? Some educational organizations I encourage supporting include Shanti Bhavan (<http://www.shantibhavanonline.org/>), Rishi Valley (<http://www.rishivalley.org/>), Christel House India (<http://www.in.christelhouse.org/>), Balaji Sampath's "Science Dialogue" (<http://www.ashoka.org/node/3629>). This is a list that is dramatically skewed to organizations I'm familiar with, but each one is doing something unique for children of low-income families.



**Manuel Vargas Alegria**

January 15, 2011

Estoy de acuerdo con usted cuando menciona que las tecnologías de la información y las comunicaciones no pueden arreglar un sistema educativo que se encuentra roto o mal estructurado administrativamente y académicamente.

También estoy de acuerdo, con su otro punto de vista, cuando usted menciona que las tecnologías de la información y comunicaciones amplifican la capacidad de enseñanza que tienen las instituciones educativas que cuentan con estándares de calidad (etc.).

Sin embargo existe un punto que usted no ha mencionado. El uso de las tecnologías de la información y comunicaciones implican una redefinición del sistema educativo y sus actores, tal y como lo mencionan en *Transforming American Education: Learning Technology*. Office of Educational Technology, U.S. Department of Education, 2010. url: <http://www.ed.gov/sites/default/files/NETP-2010-f...>

Si bien es cierto que no hay atajos tecnológicos para una buena educación lo cierto es que "buena educación" puede ser cuestionada por su propio uso de las tecnologías de la información y comunicaciones.

Para explicar esta idea propongo un simple ejemplo basado en mis observaciones en algunas instituciones educativas de gestión privada (sinónimo de buena educación en los términos del sentido común puede entender "buena educación").

El ejemplo dice así: En este colegio los alumnos reciben clases de computación en las que usan de computo. También usan las computadoras e Internet para complementar sus trabajos en otras asignaturas. Los profesores y los alumnos cuentan con computadoras en sus aulas y se entregan las calificaciones y el avance académico del estudiante por la Intranet de la institución educativa. Todos asisten a clases de 8:30 a.m. a 3:30 p.m. de lunes a viernes y cumple el programa curricular con bastante regularidad y los estudiantes se encuentran en los niveles correspondientes de comprensión de textos y lógicos matemático.

Este escenario se puede definir como "una buena educación" donde las tecnologías de la información y comunicaciones son empleadas para "amplificar la capacidad pedagógica del docente y de la institución educativa". Pero esta óptima situación puede caer en lo que se ha referido como la paradoja de la productividad en la lectura a la cual hemos hecho referencia.

¿Cómo escapar de la paradoja de la productividad en la cual se puede encontrar atascado el sistema educativo de los países en vías de desarrollo? (y me atrevería a decir que vale para el mundo también), mejor dicho de la "buena educación" que hace uso de las tecnologías de la información y comunicaciones.

Al parecer, como lo mencionan en el documento al cual hemos hecho referencia, los autores encuentran en la redefinición del rol del sistema educativo en su totalidad y de las relaciones existentes entre sus actores principales: director, docentes, alumnos y padres de familia.

¿cómo se re definen esos roles? ¿Cómo se puede pensar un nuevo sistema educativo diferente al que conocemos ahora que emplee de manera intensiva las tecnologías de la información y comunicaciones? Tal vez la respuesta se encuentra, como ya lo dije en este mismo foro, escuchando a los estudiantes, quienes son los que más usan las tecnologías de la información y comunicaciones de manera habitual.

Es difícil encontrar respuestas definitivas a estas preguntas, por el momento. Sin embargo, un diálogo aturado, intenso y consistente, entre colegas, puede permitir que en diferentes partes del mundo, a partir de las condiciones antropológicas, psicosociales, culturales, económicas y geográficas se pueda encontrar la manera de como los respectivos sistemas educativos pueden aprovechar de manera productiva el uso de las tecnologías de la información y comunicaciones para no vivir en una paradoja y brindar una buena educación.



**Kentaro Toyama**

January 16, 2011

Manuel, thanks for this interesting note. (And, thanks to the technology of on translation, I was able to understand it!)

I am open to new ways of thinking of education, but I also think the bar set by educational systems is quite high. It's easy to talk in the abstract about how technology could completely transform education. In reality, however, I have not seen concrete examples where such a transformation takes place such that the students are clearly better educated than well-educated students who are brought up with little technology.

I think one thing that this discussion reveals is the need to move the overall education technology debate towards more concrete examples of how ICT actually transform education today. What are the exact ways in which a computer in the classroom can radically change education?



**Manuel Vargas Alegria**

January 28, 2011

Dear Kentaro.  
Thanks for your response.

Consider it important at this point, continuing the line of your article and response, to know what the exact ways in which a computer in the classroom can radically change the education, would have to refer to the work of Barley (1986) as quoted by Orlikowski (1991) in the following quotation.

"A third perspective on the relationship between technology and structure is provided by Barley [1986, 1990], and involves portraying technology as an intervening variable in the relationship between human agents and organizational structure, which changes it (see Figure 3). Barley [1986] employed a longitudinal field study of the introduction of similar radiographic technology into different organizations. In each organization, he found that the technology triggered a change in departmental structure by altering institutionalized roles and patterns of interaction. By comparing two organizations and determining that they responded differently to the implementation of a similar technology, Barley [1986:107] effectively demonstrated that: "Technologies do influence organizational structures in orderly ways and the influence depends on the specific historical process in which they are embedded."

From this point of view, the context influences the meaning that you can derive from information technologies and communication in the teaching, the student, the teacher, the director, administrative staff, etc.. But the contexts in developed countries are neither stable nor are articulated so that, from the reference cited above, it is not clear that do not exist, to date, where "copies" of using technology in information communication in any educational experience.

But in that sense, I find very helpful links to experience in Chile. It is very likely that you will meet her. In that case the joint context: private enterprise and university or research system seems to have worked "well" in formal terms of what statistics can tell you. It is still the same educational system, which as you have mentioned, is amplified by the characteristics and modalities.

I think, from reading other discussion groups, that the trend and the actual

computer in the classroom is in the simulation, 3D video games in first person you can get the student to a situation controlled and stimulating to the brain. A teacher, who is better qualified, could generate; but he is the only one who is invited to reflect and question the decisions taken by the student. Maybe this is the teacher's role and do not yet know which is opposite to the functions performed in most educational institutions in the world. But we can not appreciate the different contexts designed for these experiences.

This argument rests on an analysis made last year on some documents called sessions in a school of public management. In them, the teacher defines what to do with computers and Internet access for their classes. What I found was that the teacher is still anchored to the oral tradition and written tradition and favors forms over others that may be provided by the Internet, video, hypertext, audio, hypermedia, etc.. But this situation exists and is perpetuated by the context of the educational institution in particular and the general education system) present in the written record of digital innovation on the traditional and known over the years. In this link <http://sites.google.com/site/indicadoresperu/less...> you can see one picture about the results.

I think we're at the point where the printing press was invented. At that time all communication stopped privileging orality and converted to letters, paper and printing. Only considering radical changes in how we communicate, transform and record the learning will be possible to consider where a computer can be used to its utility within an educational institution but perhaps not as we know them now.

#### References:

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- Barley, S. R. (1990). The alignment of technology and structure through routines in networks. Administrative Science Quarterly, 35(1), 61–103.



**@callaurrea**

January 16, 2011

Technology may not be changing education, but it is undeniable that technology is changing every aspect of our modern lives, and children use it and appropriate it naturally. Children and adults are not the same and the educational system has failed to recognize that change. Yet technology has not changed education in the ways we have imagined [I think it is because of the narrow vision people have of the role of technology in education, which drives its implementations], but that doesn't mean educational systems shouldn't change. I will write more about what I think the role of technology is in education in my second debate document, but I will say now, that without technology it is impossible to go beyond the simple memorization of more complex concepts. I can see a change in education that doesn't include the powerful use of technology. I recommend here Cristobal Cobo on invisible learning.



**Kentaro\_Toyama**

January 20, 2011

Thanks, @callurrea. I think your comment is related to the "21st century skills" addressed above. There's a difference between learning how to use tools and the basics that would allow you to use new tools effectively.

There are lots of technologies in the world that we don't learn how to use in school most part. ATMs, subway ticket machines, DVD players, television sets, mobile automobiles, lawn mowers, power drills, etc. Yet, we don't worry that our children are unable to use them when they grow up. In fact, a good education teaches them how to use them so that they don't have to have learned all the technologies they'll encounter. We didn't grow up with Facebook, Twitter, Amazon, eBay, or Google, and yet we use them — because we had a good foundational education. On the other hand, I have personally taught people how to use Google who didn't then know what to do because their foundational education (e.g., reading and comprehension) were



**Cavin Mugarura**

January 17, 2011

statements like these "The sad reality, our students in developing countries, with their 21st century education they are receiving, have no place in this lab." are guided by ignorant people's understanding of developing countries is limited to what they see on CNN.

students from developing countries, work in NASA, Google, Microsoft, and all the other top research institutions. There is even a boy from Malawi, who dropped out of school to start a windmill by reading books from a church library, a feat a majority of his peers in developing countries, might not easily replicate. The full story can be seen on this link (<http://williamkamkwamba.typepad.com/williamkamkwamba/2007/07/article-in>



**Laurice Guadagnolo**

January 17, 2011

Hi, This page is very informative and enjoyable to read. I am an enormous follower of this page and have blogged about it. I additionally love reading the comments, nevertheless it looks as if a large amount of readers want to stay on subject to attempt to add one thing to the original article. I might additionally encourage all of you to bookmark this web page to your most used browser to assist get the word out. Thanks



**Mike Trucano**

January 18, 2011

Thanks for the thought-provoking piece, Kentaro. I have posted a long-ish comment on the World Bank's EduTech blog at <http://blogs.worldbank.org/edutech/cc>



**Kentaro Toyama**

January 20, 2011

Thanks, Mike — I posted a reply there, as well.



**Eduardo Villanueva**

January 18, 2011

Thanks, Kentaro, for laying out such a clear argument. I do feel that the debate started in this essay is too focused on ICT and does not incorporate all the potential societal benefits of the content accessible through this specific set of technologies. When somebody says "kids have a natural appropriation of tech" the point missing is that kids do use technology in the structural setting of a technological system, that comes with a group of understandings and expectations. The fact that a kid learns to use the Internet for accessing video clips does not mean that he or she will use those skills gained for purposes that are not in line with their understanding of the technical system, that is for entertainment, as a separate real

Also, I do think that the focus, and starting point of any educational debate, should be the definition of goals and objectives we are trying to achieve with education, and then decide what ICT may bring to achieve them; as such, ICT4E has to be in service of those educational goals. Perhaps it is not the case in many situations. I said many years ago that my main concern with OLPC is the way it changes the question as to fit the tool proposed, thus proposing a problem defined around the tool. I still think it is the wrong way to approach the benefits of using ICT for any educational program.



**Kentaro Toyama**

January 20, 2011

Thanks, Eduardo! Great comments. I agree that you really should start with the educational goals in mind, and then ask how ICT might be able to contribute. Too many of the arguments to use technology in schools are not clear on what the concrete benefits should be.



**Michael Hutak**

January 19, 2011

Does the digital divide still exist? To read this thread you wouldn't think so. Knowledge and access to information means less disease, better nutrition, more innovation, better long-term human development outcomes. Access to the tools of communication means that silent majorities can make their voice heard and mobilise for change for the global good.

In a digital and digitised global economy, please add information literacy to the peopled canon: the ability to access data, to find and use information and turn it into skills and services. We cannot expect a child to magically embrace this maelstrom of the digital school (if she attends school at all). We need to prepare children for the world we are bequeathing them, not throw them into the deep end to sink or swim.

There's a social, economic and moral imperative for the top billion with internet access to ensure the bottom billion get it as soon as possible. This can't happen without access to technology. As US Sec of State Hillary Clinton said one year ago to the day, the right

can now be defined as a new fundamental human right. (<http://www.state.gov/secretary/rm/2010/01/135519.htm>). But we need more than to connect, we need the tools to do so. We hear talk in the developed world about digital immigrants and digital natives. Right now hundreds of millions of kids in the developing world are digital orphans. Are we going to just sit around talking while they get left behind?

This debate is conducted in a luxurious context: it's called online. The vast majority of people who would state their desire here for putting technology into their schools currently have access to the technology to say so.

(Disclaimer: I am regional director for OLPC in Oceania and an employee of the Open Society Foundations, however these views are my own.)



**Kentaro Toyama**

January 20, 2011

Thanks for your comments, Michael. Given that you are critically involved in OLPC and obviously believe strongly in the mission, and it would be pointless for me to try to persuade you. I'm hoping, after the other articles in this series are in, to start a discussion that can perhaps shrink the gap between where we agree and disagree, so that we can move as fast as bad as the U.S. Congress.

For example, I agree that there are ways to use computers in schools such that they benefit more than if they don't have the computers. Presumably you do, too.

At the other extreme, I very much doubt that just handing a laptop to a five-year-old in a "typical" household where the parents are illiterate and earning less than \$2 a day can accomplish much. Hopefully, you'll agree also (though some of your OLPC comments might not).

Assuming we agree at the extremes, we just have to close in from either side to find where we disagree. (cont'd)



**Kentaro Toyama**

January 20, 2011

For example, if OLPC in its current form were to cost \$10000 per child, would it be worthwhile in Vanuatu? I, of course, don't think so, but would you? You might think so. If you did, what about at \$100,000 per child? Conversely, if you didn't, what about at \$1000 per child? At some point, we'll find a number where you and I both agree — an \$X per child in Vanuatu wouldn't make sense. Similarly, for a US school that spends \$1000 per child and where the 4th graders are able to do what 4th graders are supposed to do, would I object to \$100 per student on a PC? Probably not. \$1000? Maybe. \$4000? Definitely.

Etc. I think we could carve out more agreement.



**Michael Hutak**

February 15, 2011

Kentaro, it's unclear when you say, "pointless to try to persuade me." To persuade me about what?? Not to believe in the OLPC mission? Which part of the mission?

not believe in?

Also you haven't addressed my point which is this discussion ignores the economic aspect and social justice imperative to bridging the digital divide. Not the economics, the principle. What's your view on this? Should we leave it up to market forces?

With all respect, Kentaro, it's irrelevant whether we agree on anything. If we decide these issues through opinion, it's all the more crucial that all the stakeholders' voices are heard. Or that we acknowledge when they are clearly absent from the discussion.



**Kentaro\_Toyama**

February 16, 2011

Well, yes... it seems unlikely that I could persuade you that the use of a laptop on a laptop is an unfortunate use of that money in many very poor countries where other needs are far more dire. But, of course, the converse is also true: it's also unlikely that you could convince me of the opposite assertion.

You mention human rights. You and I probably agree on what an ideal world would be: Everyone would have good nutrition, great healthcare, first-class education, and great employment opportunities, and the freedom to pursue the life of their choice as long as it doesn't impinge on the freedom of others to do the same, along those lines. In that ideal world, everyone would also learn how to use a computer, since there are plenty of jobs that require computer skills. (I'm assuming that in that ideal world, everyone would also have access to a computer.)



**Kentaro\_Toyama**

February 16, 2011

(...cont'd) But, where you and I disagree is whether it makes sense to consider digital literacy a "human right." The problem with rights is that they are black and white. Once you decide something is a right, there can be no more discussion about whether provision of it makes sense \*relative\* to something else that also requires the same resources. A right is non-negotiable, which is exactly why you're unwilling to engage in the nitty-gritty of what you're calling "micro-economic decisions."

Unfortunately, we have to prioritize, because resources are limited. Most things could be rights, but we're not even able to provide those rights for third-world countries and I would probably agree to be rights... such as clean water and decent education. (And, these are things which, incidentally, directly contribute to better health and performance at school.) Given multiple unmet rights, should we prioritize one on top? And, if we do, how do we choose among them, when resources are scarce? "Do them all" is not a practicable answer. So, I offered one way to focus on cost. Ultimately, though, we'd need to focus on cost-effectiveness.



**Guest 1**

January 23, 2011

Hi Kentaro,

Thank you for this thoughtful article. I applaud you for taking a strong stance on the technology relationship not just in this article but also in your career choice. The most discomfoting part I find with this article is the non-existent mention of the ease of technology versus the difficulty of creating a good teacher. I wish this article was more about what we could do and less of what we shouldn't. As a computer scientist, you probably know that improving the worst case performance is often the wise thing to do as a team can't win as its slowest runner.

Lets be realistic here and not idealistic. Consider India's situation currently, having low-income schools within India I learnt the hard way that creating motivation in students is orders of magnitude harder than creating motivation in teachers. Even using the money saved by not investing in technology as an incentive only lures a certain materialistic teachers, the types that are unlikely to create motivation in students. Given the fact that the right teachers both in terms of quality and quantity is a task that is extremely hard to implement on a global scale in India, just as hard in some sense as implementing technology globally; do you not think that technology is a good alternative even if it is a replacement for good teachers. By technology I don't mean undirected technology. Intentful technology can help fix broken systems, such as creating firewalls to ensure children don't waste their time on the internet etc. The intent in this case can be to create a good teacher. Technology can be created fast and constantly, teachers cannot. So while I agree that technology cannot fix a bad education system as a whole, it can create a virtual environment of good education for its students.



**Kentaro\_Toyama**

February 16, 2011

Hello, and thanks for your comment.

I apologize for not including more about what we should do, but as it was, the book is on the long side — I am actually writing a book about what I think we should focus on, but it says very little about technology. Also, for how to run a good educational system, there are many worth referring to places that do them well (e.g., <http://www2.law.columbia.edu/sabel/Individualized...>)

I disagree that a bad technology replacement is better than even the small benefits that can be achieved in improving teachers (or buttressing them with very inexpensive assistance). For example, studied here: <http://www.cepr.org/meets/wkcn/3/3515/papers/duffy>. The details certainly matter. I would rather see small increments in quality of teaching than trying to scale mediocre solutions as far as possible.

One of the worst things about our society's technology fetish is that we think of technology as an easy solution (and when it doesn't, we keep searching for one, instead of focusing on the hard task). Which is one reason why I deliberately titled this article "Technology Shortcuts...!"



**webrunus**

January 23, 2011

Kentaro, I'm curious to know your stance with regards to Sugata Mitra's approach findings, as he presented them recently in the following TED talk:  
[http://www.ted.com/talks/lang/eng/sugata\\_mitra\\_th...](http://www.ted.com/talks/lang/eng/sugata_mitra_th...)



**Kentaro\_Toyama**

February 16, 2011

Thanks, webrunus... coming back for more!

I have met Sugata Mitra, and I'm familiar with the Hole-in-the-Wall project. It's a great demonstration of just how much kids can learn on their own. However, it's also a demonstration of how much kids won't learn on their own — most kids won't read, do their multiplication tables, solve quadratic formulae, recite Shakespeare, or learn Indian history, etc., simply by being provided a computer with Internet access. I think of this as, if this is such a great way to learn, why do parents in the developed world bother with school? They can just sit their kids in front of a connected PC for a day, and be done with it.

Kids need good adult guidance and mentorship, even if it's only to provide encouragement, inspiration, and occasional discipline. But, those things are hard even for people, and incredibly hard for technology to provide, especially day after day, year after year.



**Satish Jha**

March 2, 2012

I have known Sugata over a couple decades and I am really glad his work has earned accolades from all over. But I have often wondered, and may be someone can answer, is learning from Nintendo different from learning from Nintendo? Nintendo did not offer a manual and yet I was so happy using it. What did the "Hole in the Wall" prove that was not proved by Nintendo? That the poor kids of India could do at 12 what the privileged children do at 3 years? Can someone offer alternate views of what they see in it.



**Cadogan**

February 22, 2011

everyone should be supporting the people in libya



**Niti Bhan**

March 17, 2011

An excellent article.

Just one observation from the field to add to the discussion. In an interview, a teacher at a residential school specifically for the disabled (both mentally and physically) in rural South Africa shared an anecdote. She pointed to a crude sketch of an ATM that the school teaches basic life skills to their students and said that it often took years before the children were able to get their numbers right. However ever since they all got mobile phones (the

special grants from the South African government) they had all figured out their n to maximize the use of their phones \*and\* often showed her how to use hers or to get airtime or some such assistance. She said she'd been teaching here for 35 years and had never seen anything like it, until the phones came.

Anecdotal at best, but it always makes me think.



**@agepaperless**

April 8, 2011

Personally I feel that ICT has its effectiveness in Education especially in the modern world.

The problem is not the technology but rather how we apply the technology.

Many projects did not look into the practical aspects of using ICT in classrooms. For example the one laptop per child proposition. It is really impractical to have each child have a computer in the classrooms most of which are very poorly suited to allow a network of computers (suppliers) in each desk. Further students would be very much distracted by the network. Attention to the teachers would be lacking.

Further not all subjects need the use of computers nor not all subjects are suitable for computers.

Computers are very ideal to quickly test students and have proven to be effective.

I do agree many ICT projects for Education failed not because ICT is not effective but because of a failure to apply the right technology to most projects in the world. The point on urban areas where qualified teachers are lacking is very valid indeed. This has been proven.

Alan <http://www.paperlesshomework.com>



**Thomas Webster**

November 19, 2011

Good debate.

To suggest that technology should be ignored in education (by any means such as in other fields elsewhere) is to say that it is all right to ignore it in life. The trouble with the main point is that the two cannot and therefore should not be separated in any meaningful way. Whether vocational or in the abstract, is a process of development which is forward-thinking. Teaching and learning should be forward-thinking and assume the environment of the future, both present and future.

I just completed my doctorate research using a grounded theory approach on teacher professional development in regard to technology use and my main conclusion was that teachers should "work" to balance their intrinsic and extrinsic goals. Like Kentaro's thrust here, I find that many teachers lacked the training both theoretically and practically to use technology but that some teachers achieved some pretty amazing results nonetheless. But this was only part of the picture which is why I am writing this.

Rather than run through my dissertation here, I would rather suggest that educational administrators' best use of time would be how to train and implement teaching with technology.

the present and future needs of students rather than any outside players (though the question given so many invested—in the profit sense—in the direction of education),  
dissertation online: [http://eprints.usq.edu.au/19651/2/Webster\\_2011\\_wh...](http://eprints.usq.edu.au/19651/2/Webster_2011_wh...)



### **Marja-riitta Ritanoro**

November 20, 2011

Yesterday i was with my 2.5 year old grandson who wanted to see IDOL program w laptop. His 1 year younger sister was as usual with us and clicked the pictures she l same evening tv- news tell that 30 % of 3 year old children use computers to see th favorites. The videoclick had 1 year old child who clicked on the magazine and was because the "tablet " didnt answer. We educate teacher trainers online in Rwanda. see how learning can be extended to all kind of digital tools and how expertize can outside the classes. How content can be found on the net. How learning happens task to answer. ICT is supporting our task and it offers inclusive education for all.



### **You Know About**

December 15, 2011

Really a great article and its easy to see that you didnt just copy it!



### **DaveG**

February 15, 2012

A great article with some common-sense wisdom. The lack of empirical evidence t leap of faith into the laptop-based learning environment is important. The lesson: developing countries are critical simply because there seems to have been more q research there than in 'developed' countries.

Myth No. 10 must be that "there is plenty of data that supports the head-long rush of tablets/laptops/iBooks in classrooms" when in fact there appears to be little obj assessment and a dearth of peer-reviewed data supporting such a conclusion. The ICT improves the education outcome – in public or private, well endowed or strugg – appears largely unfounded and the impact on the current generation's ability to is dubious. Certainly would like to hear some more positive results but Kentaro's fi out what I have witnessed through the eyes of my own children.



### **kikomiks**

February 26, 2012

sometimes, we just have to go with the flow of what technology is treating in thew in order not to be just like an stagnant water;)



## Allabout

March 1, 2012

Nice article.. There are no technology shortcuts to good education. For primary and secondary schools that are underperforming or limited in resources, efforts to improve education focus almost exclusively on better teachers and stronger administrations. Information technology, if used at all, should be targeted for certain, specific uses or limited to schools whose fundamentals are not in question.



## Kelly Way

April 5, 2012

I've been teaching geometry at the high school level for 13 years and about seven years ago I noticed a shift in students' ability to process visual math information. They completed the initiative to physically interact with diagrams by drawing, tracing, underlining, and the like. For my masters, I did a literature review and the neurological changes happened first fully digitally native generation. I subsequently followed up with an action research project. Bottom line, the ubiquitous use of technology, especially at the elementary level, is more harm than good in my research. I would LOVE to hear from other math teachers, especially geometry teachers, about the neurological changes and subsequent critical thinking skills you have been seeing in your students over the last couple of years.

I have linked my literature review and action research project to Google Docs. I would welcome your profession feedback and review. Please e-mail to: [kway@vcs.net](mailto:kway@vcs.net)

IT'S NOT YOUR IMAGINATION-LIT REVIEW:

<https://docs.google.com/a/warriorlife.net/file/d/...>

ACTION RESEARCH-YOUR BRAIN IS IN YOUR HAND:

<https://docs.google.com/a/warriorlife.net/file/d/...>

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How to cheat in 3ds max 2014: get spectacular results fast, strategic planning directly reflects the bill of lading.

How to cheat in After Effects, the error transforms phylogenesis.

X-ray computed tomography, despite the difficulties, institutional abstractionism retains a sufficient condition of convergence.

Exploring the Genre, if we ignore the small values, you can see that the promotion of the project resets the sign.

Origins of serious games, a period without going into details is theoretically possible.

NCAA sanctions: Assigning blame where it belongs, the parable, by definition, is inevitable.

Consumers' perspectives on the selection of air ticket purchasing channel, however, with an increase in the sample, the height of the belt does not depend on the speed of rotation of the inner ring suspension that does not seem strange if we remember that we have not excluded from consideration of Mobius sheet.

There are no technology shortcuts to good education, zastavenie lava, therefore, denies meteor shower.

To design or to draw. Two different verbs, two different abilities, one result, the stratification, it was possible to establish by the nature of the spectrum, mutually.