Teachers and tablets, mobile devices and 'MOOC Times':

Innovations in technology use in education in developing countries

Excerpts from the World Bank’s EduTech blog (Volume VII)

Michael Trucano
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U.S.A.

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Top World Bank EduTech blog posts of 2015
by Michael Trucano

#1: originally published on Tuesday, 05 January 2015

For the past seven years the World Bank’s EduTech blog has sought to "explore issues related to the use of information and communications technologies (ICTs) to benefit education in developing countries".

While there are plenty of sources for news, information and perspectives on the uses (and misuses) of educational technologies in the so-called 'highly industrialized' countries of North America, Europe, East Asia and Australia/New Zealand, regular comparative discussions and explorations of what is happening with the uses of ICTs in middle and low income (i.e. so-called 'developing') countries around the world can be harder to find, which is why this remains the focus of the EduTech blog.

The term 'developing countries' is employed here as convenient (if regrettable) shorthand in an attempt to reinforce the context in which the comments and questions explored on the blog are considered, and as a signal about its intended (or at least hoped for) audience. That said, given how much we still don't know and the fact that things continue to change so rapidly, when it comes to technology use in education, as a practical matter we all live in 'developing countries'.

When speaking about some of the early EduTech blog posts, one rather prominent and outspoken commenter (rather comfortably ensonced at an elite U.S. research university, for what that might be worth) said basically that 'there is nothing new here, we've been aware of all of these issues for some time'.

This might possibly be true – if you are a tenured professor sitting in Cambridge, perhaps, or a technology developer working out of Helsinki, Mountain View or Redmond.

(One could nonetheless note that being aware of something, and doing something useful and impactful as a result of this awareness, are not necessarily the same thing, a lesson that seems to need to be learned and re-learned again and again, often quite painfully and expensively, as 'innovations' from 'advanced' places are exported to other 'less advanced' places around the world with results that can at times be rather difficult to determine. It is also perhaps worth briefly recalling the insightful, if
However, these are often relatively new discussions – *and often very different discussions, it should be noted!* – in other, less 'economically privileged' parts of the world. As computing devices and connectivity continue to proliferate, practical knowledge and know-how about what works, and what doesn't, when it comes to technology use in education is increasingly to be found in such places. It is to participate in, learn from and help catalyze related discussions that the EduTech blog was conceived and continues to operate.

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While the posts in 2015 were published less frequently, they were on average much longer than in the past ('too long!', some might say) and largely explored themes (e.g. 'tablets', 'teachers', 'coding') drawing on experiences across multiple countries, rather than profiling specific individual projects or activities in one place, which was often the case in previous years.

It perhaps shouldn't need to be said (but I'll say it anyway, as I am obliged to do) that, whether taken individually or collectively, nothing here was or is meant to be definitive, exhaustive or 'official' in its consideration of a particular topic or activity. The EduTech blog serves essentially as a written excerpt of various ongoing conversations with a wide variety of groups and people around the world and as a mechanism for 'thinking aloud in public' about these conversations. Nothing is formally 'peer-reviewed' before it appears online, and the views expressed are those of the author(s) alone, and not the World Bank. (If you find a mistake, or just really disagree with something that appears on the EduTech blog, please feel free to blame the guy who writes this stuff, and not his bosses or the institution which employs him).

With those introductory comments out of the way, here are the ...

**Top World Bank EduTech Blog Posts of 2015**

10. **Edtech and MOOC Times in China**

Despite a common impulse in many quarters to look instinctively to Silicon Valley when it comes to 'innovations' in technology, including those used in the field of education, some of the most interesting developments are happening at a large scale in places where many folks are unaccustomed to looking. In past years the EduTech blog has explored many emerging lessons from places like **Uruguay**, for example, which was the first country to provide all primary school students with their own laptops. In 2015 the blog considered some interesting developments in China, as well as insights from an effort largely unknown outside the borders of the country where it has been taking place: **The introduction of large scale computer adaptive testing in Georgia** (the country in the Caucasus, that is, not the U.S. state).
9. New landmark OECD PISA study on 'Students, Computers and Learning: Making the Connection'
Given the lack of data about what actually happening with, and as a result of, technology use in classrooms around the world, 'edtech' has been referred to by some as the real 'faith-based initiative' in many education systems. While some may argue that the related data that are now beginning to emerge represent only certain pieces of a larger puzzle, and that we should be careful about drawing generalizable conclusions from related analyses, it is nonetheless heartening that we are now starting to see results of well-funded data gathering exercises that are informed by real scientific rigor. A study from the OECD utilizing PISA data was one notable example of this in 2015, as was an effort led by the UNESCO Institute for Statistics on Surveying ICT use in education in Africa.

8. Video games, screen time and early childhood development
Generally speaking, parents around the world are keen to make sure that their children have access to new technologies to support their learning. And yet, as such access increases, they also lament the fact that their children are spending too much time staring at screens of various sizes. Whether they view ICTs as tools for learning or devices for distraction -- as a practical matter they are both, of course -- parents and educators are conflicted and confused about how and how much to utilize new technologies to support student learning. Given related potential health issues (both real and imagined) and the increasing ubiquity of screens, such conflicts can be particularly acute when it comes to the youngest learners, who are (for better or for worse) increasingly to be found gazing at a screen themselves, whether it is found in a television at the corner of the room or, increasingly, on their parent's mobile phone.

7. Using the Internet to connect students and teachers around the world for 'virtual exchanges'; More comments on using the Internet to connect students and teachers around the world for 'virtual exchanges' & Establishing and connecting leagues of innovative schools around the world
A longstanding rationale for connecting schools and students to the Internet is not only that they can access the wealth of learning materials available but also so that they can connect to each other. A pair of posts explored very practical lessons that have emerged from related efforts around the world to connect teachers and learners across borders; a third looked at a way to organize such activities. Another post, Universal Service Funds & connecting schools to the Internet around the world, examined one way that governments around the world are using to help fund and support such activities.

6. Key themes in national educational technology policies & Lessons from the drafting of national educational technology policies
Under its SABER-ICT effort, the World Bank has been collecting and analyzing educational technology policies from countries around the world, as well as the processes which inform and bring about such policies. These two posts shared some of the related findings from this initiative.
5. **Innovative educational technology programs in low- and middle-income countries**

*The future, it has famously been said, is already here, it's just unevenly distributed.* (You've probably seen that observation reproduced in a PowerPoint presentation or in an article in the popular press even if you are not familiar with the science fiction author William Gibson, who coined this oft-cited aphorism.) The World Bank's EduTech blog exists in part to help document particular instances of this uneven distribution related to the use of educational technologies; the Center For Education Innovations did some great work in 2015 in cataloging and analyzing over 200 related innovative educational technology programs that many folks had probably never heard about.

*Innovation* -- whatever that may mean -- was undoubtedly the buzzword of the year in the field of education, and for many folks the fact that some new technology was used to do something that had previously been done without technology made such an activity, by default, 'innovative'. *Prizes, literacy and innovations in education* explored one way that innovations in education are meant to be catalyzed and recognized. *Complexities in utilizing free digital learning resources* and *Learning to code vs. coding to learn* looked at issues related to two worldwide movements to introduce *innovations in education* through the use of open educational resources and by teaching students to write computer code.

4. **Banning and unbanning phones in schools**

Mobile phones are regarded as the fastest growing consumer technology of all time. Do they have a place to support student learning and, if so, should they be allowed in schools? This post examined related issues and activities in education systems around the world. A sort-of companion piece, *Common (and uncommon) approaches to preventing the theft of computers, laptops and tablets in schools*, catalogued some of the ways that education systems are attempting to make sure that whatever technology devices exist in schools don't disappear.

3. **Tablets in education**

When it came to educational technologies, it used to be all about desktop computers. Later laptops were the 'answer'. Now in many education systems around the world, tablets are all the rage. What's happening in this regard, and what are we learning as a result?

2. **Research questions about technology use in education in developing countries**

The most-read EduTech blog post of 2015 examined not some of the latest cool technologies being developed or piloted in schools around the world, but rather some of the related research questions of potential interest and relevance to education policymakers and practitioners. Reasonable people can perhaps agree to disagree on what the most important related research questions should be, and how to go about answering them, but there is no denying that we need to be asking more relevant ones that we have asked in the past. (Of course, in most cases, we haven't really asked many useful related questions; 'technology' has represented an
'answer' to questions which were largely unarticulated, if indeed they were posed at all).

1. **Will technology replace teachers? No, but ...**
The top EduTech post of 2015 examined the hope or fear (depending on one's perspective) that 'technology will eventually replace teachers'. This post sought to add some nuance to related (and sometimes fiery) debates, which often throw off more heat than illumination.

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OK, that’s the list of **top World Bank EduTech blog posts for 2015**. Thanks a lot for reading, and for sharing and commenting on the posts in whatever way you may have done so. We greatly appreciate you taking time out of your busy day to spend a few minutes with us every so often.

**A reminder:** You are always free to reproduce, re-post or re-publish the EduTech blog posts in whole or in part, in whatever format you find most useful (in your newsletter or publication, excerpted on Facebook or Twitter). You can grab our RSS feed [here](#); a link to each post is Tweeted out via the @WBedutech account as soon as it goes live. All that we ask is that you acknowledge the source and provide a link back to where a particular post originally appeared.

*Thanks a lot, and see you in 2016!*
-M

ps For those who might be interested in such things, here are links to the collections of top posts from previous years (**2014; 2013; 2012; 2011; 2010; 2009**) as well as the annual compilations of all EduTech blog posts (**2014; 2013; 2012; 2011; 2010; 2009**). More background on the World Bank’s EduTech blog is available [here](#).

**Note:** The image that appears at the top of this blog post of the presentation of a small box of delectables to two ladies at a Korean cultural celebration in Seattle (“take your pick -- some are rather yummy!”) comes from the Wikipedian Joe Mabel via Wikimedia Commons. A nod to the strong partnership between the World Bank and Korea’s Ministry of Education (and especially KERIS, the Korean Education Research & Information Service) on educational technology issues, it is used according to the terms of version 1.2 of the GNU Free Documentation License and the Creative Commons Attribution-Share Alike 3.0 Unported license. As a way to help familiarize people with the variety of Creative Commons licenses available for use (and re-use), the EduTech blog regularly features CC-licensed images from Wikimedia Commons.
Will technology replace teachers? No, but ... 
by Michael Trucano

I've worked on, advised and evaluated educational technology projects in dozens of countries over the past fifteen years, mainly in middle and low income countries.

As anyone who works intimately with information and communication technologies (ICTs) on a daily basis knows, change is a constant when working in the technology sector. (In contrast, while rhetoric about change is a constant in the education sector, change itself is much slower in coming ....) While the technologies themselves may change quite often, though, many of the most common questions related to their introduction and use remain largely the same.

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I remember working with teachers in Ghana in the late 1990s as part of a pilot initiative to introduce computers and the Internet into a select number of schools in a few of the major cities. Towards the end of the third day of a five day workshop, we had a teacher show up at the door to our classroom, apologizing for his tardiness and asking if he could join the course. He explained that he had traveled for a few days to reach the small school outside Accra where our training activity was taking place, hitching rides on trucks and then transferring between long haul buses, because he had heard about this thing called the Internet that was going to "change education forever" and just had to see it for himself. Given how many people had wanted to take the course, we had a strict policy not to allow latecomers into the workshop, but we waived it for this gentlemen, because we were so taken by his story and by the hardship he had endured to join us.

We waived the policy for another reason as well. It is decidedly not politically correct to say so, but we also allowed this teacher into the class because he was ... old. He claimed to be over 70, but said he wasn't exactly sure of his exact birthdate, other than that it had occurred on a Friday. While my Ghanaian colleagues expressed some skepticism that this fellow was actually as old as he claimed, there was no doubt that he was decades older than any of us in the room. He was an English teacher, he said, noting that he had heard that it was possible to
get access to all of Shakespeare's plays on the Internet, for free, and wanted to see how this was possible. A computer became available (the teachers using it had been frustrated that poor bandwidth kept interrupting their CU-SeeMe session and so decided to return to the dormitory before dinner), so we sat down, fired up Alta Vista, and typed in <<Shakespeare's plays>>.

After scanning the search results, one of the young teachers grabbed a mouse and pointed, clicked and scrolled her way through play after play after play. The older teacher was simply flabbergasted. He said something to the effect of, "Now I have seen everything. It has been my dream as an English teacher to be able to read all of Shakespeare's plays. Now all teachers will be able to do this. Education will change forever." We kept the computer lab open for a while so that he could be assured that all of them were indeed there ("There's Hamlet! The Tempest. Coriolanus!"); he promised that he would be the first one at the lab door once we opened the following morning. As we were shutting things down, he articulated a concern that I would hear voiced hundreds of times in the coming years, in many variations:

*It would be very exciting for me to be a young teacher today now that the Internet is coming. But I am glad that I am not a young teacher, because I fear that these computers will eventually replace us teachers.*

**Will technology replace teachers?**

*Here's a short answer to that short question:*

Introducing new technologies will *not* replace teachers.

Experience from around the world shows us that, over time, teachers' roles become more central -- and not peripheral -- as a result of the introduction of new technologies.

Introducing new technologies will, however, replace some of the things that teachers do -- and require that teachers take on new, often times more sophisticated, duties and responsibilities.

That said, teachers who don't use technology will be replaced by teachers who do.

*And:* In places where there are currently *no* teachers, technology can help in some very useful ways to, *in part*, overcome this absence.

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In my experience, introducing computers and the Internet into education systems for the first time almost always meets with resistance -- sometimes quite significant resistance -- from certain portions of the teacher population (and often from teachers' unions as well).
Such resistance is understandable, and perhaps to some extent even inevitable. Change can be scary -- or at least rather inconvenient.

Note that the type of resistance I am talking about here is of a very basic, initial, almost instinctive nature. It is not the resistance of teachers who, for example, have worked in a system where computers have already been introduced, with negligible or even negative effect, and who thus look on educational technology initiatives with a very skeptical, jaundiced eye. It is not the resistance of teachers who see the introduction of yet more technology as the lamentable enabler of more (and more! and more!) standardized testing. Nor am I talking about worries about wages (Will we be paid more if we are expected to learn these new 'computer skills'?) or changes in related expectations and job responsibilities (Will we be expected to do or accomplish more, or something for which we have not been trained, now that we have these new gadgets?).

No, I am talking about a more basic fear here, one that (potentially) challenges the primacy and traditional role of the teacher in the classroom and vis-a-vis her students:

*My students will know much more about computers than I do.*

*How can I not look stupid in front of them when I try to use them in my teaching?*

And, more ominously:

*Will I (eventually) be replaced by a machine?*

For those who dismiss such worries out of hand as those of people who simply fear change or 'don't get it', here's a dirty little secret: *There are many folks who secretly hope for this to happen.* Indeed, I have spoken to more than a few
policymakers over the years (and many more businessmen) who have expressed the hope that computers will provide a way for them to replace teachers. *Computers don't have unions*, a policymaker once told me. The private sector is often less secretive about their hopes for the introduction of new technologies. *We are very excited about MOOCs*, an entrepreneur once told me, *because you only have to pay one teacher to teach thousands of students, rather than a few dozen students like is the case today. Just think of the inefficiencies we can wring out of the system!*

*All by way of saying*: When it comes to teachers and technology the intentions of some of the folks behind efforts to introduce lots of new technologies into schools aren't always honorable.

It is important also to note that, while technology will not replace teachers, in places where there are currently no teachers, or where there are not sufficient numbers of capable teachers, technology can play a vital role in providing access to educational resources and opportunities for learners that are otherwise unattainable. This is not to contend that students will, if simply 'left to their own devices', be able to educate themselves to the same extent than if they had a capable teacher to help guide and support them. *Certainly not!* That said, UNESCO currently estimates that "93 countries have an acute shortage of teachers", and projects that "28 (or 30%) of these countries will still not have enough teachers in classrooms by 2030". Using technologies in an attempt to help address *some* of the educational challenges in such places while education systems work on narrowing the teacher gap seems a prudent thing to explore.

*That said:*

In no education system around the world where I have worked has the introduction of new technologies made teachers less vital or central to the teaching and learning process. *On the contrary*: As dust settles after new equipment arrives in schools (and eventually begins to work, more or less), and the initial hype around the potential for quick 'transformational change' subsides, the role of the teacher is almost always more central, indeed fundamental, than it was before the introduction of technology.

While many policymakers, education officials and parents (and even many teachers themselves) may profess a belief in the 'digital native hypothesis' -- that young people somehow instinctively understand technology and know how to use it in ways that their elders don't -- there is a big difference between being able e.g. to quickly figure out and manipulate an on-screen menu system, or to blast a bunch of aliens, or to record a short video and post it to YouTube, and being able to successfully utilize whatever new technologies are at hand in service of a student's
learning needs and objectives. For that, students need the help and guidance of their teachers.

This isn't to say that introducing new technologies will not change the roles that teachers are expected to perform, however.

While, generally speaking, introducing new technologies makes the jobs of teachers more important, more central to the learning process in many ways, it also makes teachers less central or integral (or even needed) to many of the activities currently associated with being a teacher in many parts of the world.

Books -- a technological innovation that helped transform educational practices in previous centuries -- didn't replace teachers, but they did help enable new forms of autonomous learning, and replaced and changed the nature of some of the things that teachers traditionally did.

New technologies can, and no doubt eventually will, replace many of the routine administrative tasks typically handled by teachers, like taking attendance, entering marks into a grading book, etc. (That said, in the short run, administrative burdens on teachers often increase in practice in the short term as a result of increased technology use. I once visited a school in Russia where, in a scenario that seemed to me a pointed example of pointless bureaucratic inefficiency enabled by the introduction of new technologies, frustrated teachers had been required to enter student test scores both manually on paper forms and electronically for many months, 'until the kinks are worked out of this new system'.) Standing at the blackboard in front of the class and methodically writing out dates to memorize and new vocabulary to learn -- such manual activities can often be done much more expeditiously (if perhaps not always more effectively) through using projectors and basic presentation software. Machines (perhaps even "teaching machines") may also handle some of the routine, low-end cognitive tasks (e.g. posing multiple-choice questions and grading tests) that teachers currently perform.

That said, while routine administrative burdens on teachers may (eventually) lessen, and some routine low-end cognitive tasks may gradually be taken over by software, the introduction of new technologies over time typically means that *more* is asked of teachers, not less.

The development of the types of so-called '21st century skills' -- problem-solving, critical thinking, cross-cultural communication, etc. -- as well as a variety of non-cognitive skills (such as grit and mindset) are increasingly considered to be important to success in academics, and in life. To a great extent, these are the sorts
of skills that teachers, and not machines, are uniquely able to help students develop. But doing so is not easy, and often requires more highly capable teachers than many education systems currently have. Being able to utilize new technologies in support of their teaching, and to keep up with technological changes, challenges teachers to continue to learn themselves. The increased availability of data on student performance as a result of utilizing new technologies, with their ability to track student activities in ways simply not possible when 'assessment' meant an occasional test using pencil and paper challenges teachers to absorb these data and modify their teaching in ways that are most useful to their students, both collectively and individually.

Eventually, while technology will not replace teachers, teachers who use technology will replace those who do not.

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While the proliferation of new technologies helps to enable many of the efforts to introduce more testing in many education systems around the world, it is perhaps worth considering that the sorts of things that are most easily testable using technology are, almost by their very definition, those things that are most easily taken over by machines. If you can automatically assess something (a fact, an activity) using a machine, someone will eventually write an algorithm to help a machine regurgitate that fact, or perform that activity, automatically (and most likely flawlessly).

In his recent Jefferson Lecture to the National Endowment for the Humanities in the United States, the journalist Walter Isaacson speaks about the potential for "a partnership between humans and machines, a symbiosis where each side does what it does best. Machines augment rather than replicate and replace human intelligence. We humanists should root for the triumph of this human-machine partnership strategy, because it preserves the importance of the connection between the humanities and the sciences."

And, it might be added, the importance of the human connection between teacher and student.

Note: The image used at the top of this blog post of so-called Luddites smashing a loom ("In the future, will a machine replace me and smash other machines on my behalf?") comes via Wikimedia Commons and is in the public domain. The second image of two robots ("Greetings, pupils. Please find an available power outlet, class will begin shortly") comes courtesy of the Wikipedian JosepPAL via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license. The final image, of B.F. Skinner's "teaching machine", comes courtesy of the Wikipedian Silly rabbit via Wikimedia Commons. It is also used according to the terms of its Creative Commons Attribution 3.0 Unported license; its inclusion here was inspired by this upcoming book.
We need to connect our schools to the Internet. While it may not (yet) be viable to do so in many countries, few education policymakers would question this general aspiration.

Of course, questions related to the speed and nature of this connection are being articulated and considered in different ways around the world, with answers determined by a mix of factors, including what is Technologically feasible, what is pedagogically useful and, in the end, what is afford able. Calculations around what it may cost to connect schools to the Internet, and to keep them connected, in ways that are useful and relevant to learners and teachers (as well as to administrators and families), differ widely from place to place -- as do approaches on how to pay for these costs.

Over the past two decades, I have spent a lot of time helping to facilitate policy planning sessions with governments around issues related to technology use in education. Whether this work was part of efforts by the World Links program, linked to the use of the ICT in Education Toolkit supported by infoDev and UNESCO, or as part of more mainstream World Bank advisory activities, mechanisms and approaches by which countries can connect their schools to the Internet have always been a major area of discussion.

It may seem like a small thing, but one of the signature successes of many of these planning efforts wasn't the development of a related policy document outlining a vision and approach for how new technologies could and would be used to support a variety of education objectives. That was almost always the stated goal, but, as anyone who has worked in policymaking circles knows well, committing something to paper is no guarantee that what was drafted will ever actually be implemented -- nor that what's implemented will in the end have any beneficial impact 'on-the-ground'. No, in many cases the most important thing that happened in practice was to connect a diverse set of actors from outside the education sector together with the 'usual suspects' from within education ministries. The fact that you had, in the same room and at the same time, education officials sitting together with officials
from the telecom authority, and the IT and finance ministries, as well as representatives from civil society and the private sector -- often times we found that this was the first time ever that all of these groups had talked collectively about how they might work in coordination to help meet some of the shared goals that all of them had related to technology use and education.

One mechanism that is integral to initiatives to connect schools in some countries (and thus which features prominently in these sorts of planning discussions), but which is largely unknown in others (and thus doesn’t feature at all), is the use of so-called Universal Service Funds to help pay for such efforts.

For those not familiar with the concept or practice:

Universal Service or Access Funds (which go by different names in different places) are, broadly speaking, a mechanism by which a national regulatory authority mandates, oversees and/or coordinates a set of subsidies and fees designed to promote access to telecommunication services for all of a country’s population. The easiest way to think about this is that telecom companies, as a condition of their license to operate (of their use of wireless spectrum, etc.) are required to extend access to their services to places (e.g. quite rural or geographical isolated communities) and groups (especially low income and/or historically disadvantaged groups) where there may not be an immediate or compelling commercial incentive to do so. Traditionally, this has entailed things like running telephone lines out to remote villages and supporting telephone services which telecom companies might otherwise neglect to provide. Increasingly, the concept of ‘universal service’ is being expanded in many places to focus not (only) on hardwired landlines, but also on providing mobile and Internet connectivity as well. In some countries, schools have benefitted greatly from the use of these sorts of funds.

The most famous, and indeed the prototypical, example of how a ‘universal service fund’ has been used to connect schools to the Internet is the e-rate program in the United States. A consequence of the U.S. Telecommunications Act of 1996, the e-rate has over the course of almost twenty years helped to raise the number of schools with Internet connections from 14% to effectively 100% today.

A good many other countries have similar programs (some explicitly inspired by or modelled on the e-rate program). Portugal, Morocco, Colombia and Turkey are four noteworthy examples. In still other countries (as was the case in the Philippines under the GILAS initiative), private sector companies have banded together to do something similar as part of their corporate social responsibility efforts (whether this was done for altruistic or business reasons, or perhaps to preempt potential obligations that might come into effect should a Universal Service Law come into place, is an interesting discussion, but not one that will be explored here).

That said, in many developing countries, the responsibility for the funding and coordinating school connectivity is often left by default to the ministry of education -- which, frankly, is often ill-equipped to handle this responsibility, given that it typically has little or no funds available to support such efforts (nor, frankly, any
experience or know-how in doing this sort of thing). The result: Very few schools are connected, and those that are connected are typically those in urban areas and/or which serve relatively affluent or privileged communities. (The connection itself may be rather poor as well -- a topic discussed in separate EduTech blog posts exploring answers to questions such as Broadband for schools? and How many schools are connected to the Internet?)

In such places, ministries of education may wish to consider the potential utility of so-called universal service funds (or things like them) to aid in their efforts to connect schools. Seen from one perspective, these would represent extra-budgetary, alternative sources of funding that are, at least from the perspective of educational policymakers, 'non-traditional'. Whether or not this mechanism is viable or relevant in a given country context is a determination best made locally. That said, in my experience, education ministries often don't have a strong voice on issues related to Internet provision within many countries, and so, even where such things are contemplated, discussions about the potential usage of universal service funds to help connect schools may proceed without much meaningful (indeed, without any) input from education officials.

This lack of voice on the part of the education sector is particularly unfortunate in cases where countries already have universal service funds but which aren’t spending them. The GSMA, the international association which represents the interests of mobile phone operators worldwide, noted in its 2013 Universal Service Fund Study [pdf] that "Most universal service funds (USF) remain inefficient and ineffective. Together, the 64 USFs covered in this report contain more than USD 11 billion waiting to be disbursed. Of those funds studied, many have not disbursed any money. In fact, of those USFs where levies are currently being applied and collected, it is estimated that only 64% of these same USFs have carried out some level of disbursement or reported that some disbursements have been made. In other words, more than one third of the USFs in this study have yet to disburse any of the levies collected and very few funds, if any, would appear to disburse all that they collect."

Many telecom providers (and you can see their point) look at the large surpluses which have built up in some national universal service fund accounts and claim that these monies are effectively taxes on their operations which, because they are sitting unutilized, serve no useful purpose. Give the money back to us, they say, and we’ll do useful things with it, including (possibly, to some extent) things like helping to connect schools. Now, whether or not this is something that the private sector in a given country will actually do, the fact that there are currently large amounts of money sitting unused in these sorts of accounts represents a big potential opportunity for ministries of education to help fund connectivity rollouts that they are currently unable to finance themselves. In places where existing universal service funds cannot currently be tapped to such ends because the rules and regulations in place currently do not permit such uses, considerations of expanding the potential for existing monies collected to help meet broader developmental objectives, including those in education, might be worth exploring. But if ministries of education and other key stakeholders in an education system
(including those in civil society) don't advocate for the use of funds to such ends, they perhaps shouldn't be too surprised if such things don't happen. For governments which (for better, or for worse -- at least from the telecom industry's perspective) argue for the continued existence of universal service funds but which at the same time sit on large amounts of related untapped monies, engaging with the education sector may offer one 'solution' to their 'problem' in this regard.

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While there is no comprehensive global study of how universal service funds are being currently utilized to support activities benefitting the education sector, a very useful report from the International Telecommunications Union (ITU) in 2013, the *Universal Service Fund and Digital Inclusion For All Study* [pdf], does identify where the potential exists for such uses, given current laws and regulations, in many countries around the world, including Afghanistan, Argentina, Bolivia, Burkina Faso, Chile, Colombia, Ecuador, Ghana, Jamaica, Lesotho, Mali, Mongolia, Morocco, Mozambique, Nicaragua, Nigeria, Oman, Pakistan, Paraguay, Rwanda, South Africa, Sudan, Thailand, United States, Vanuatu, Zambia and Zimbabwe. That said, the report also notes that, in many cases, there is "low activity" related to "services currently authorized under the existing framework".

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An argument could be made that the use of universal service funds is not the most appropriate way to finance activities in the education sector (some people may see this as 'robbing Peter to pay Paul' -- a criticism that can no doubt be levelled at many activities and practices supported by many governments around the world). And there is of course another, larger question related to whether such activities, where they are occurring, are having positive impacts (however one might wish to define such 'impacts').

But, for the time being, as universal service fund monies sit unused while huge numbers of schools remain unconnected, there may be an opportunity for many education systems to help kick start their plans to provide Internet connectivity to learners and teachers (or even possibly finance various projects to support so-called 1-to-1 educational computing efforts) at comparatively little cost to their own budgets. For that opportunity to be explored, however, someone has to first open the conversation.

**You may also be interested in the following posts from the EduTech blog:**

- Broadband for schools?
- How many schools are connected to the Internet?
- Checking in with Portugal's big projects to support technology use in education
- Around the World with Portugal's eEscola Project and Magellan Initiative
- Observing Turkey's ambitious FATIH initiative to provide all students with tablets and connect all classrooms

**Note:** The image used at the top of this post of a Romanesque statue in the Alsatian community of Rosheim ("maybe there's another way to support this?") comes from the
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Establishing and connecting leagues of innovative schools around the world
by Michael Trucano
#4: originally published on 10 March 2015

Back in 1997, World Links for Development began as a pilot program of the World Bank Institute exploring ways that information and communications technologies (ICTs) could be effectively used to help "prepare youth in developing countries to enter an information age". Most of the country programs (there were eventually 26 of them), especially those in Africa, represented the first organized attempt to provide schools with Internet connectivity and a suite of related teacher training and professional development support activities.

The national programs typically started quite small, with initial cohorts of 10-20 pilot schools, growing to a few hundred schools in some cases. A number of the programs were later absorbed into larger national educational technology efforts, and the global program itself gradually evaporated, its purpose to help kick start organized efforts to utilize educational technologies within participating countries no longer needed.

Over a decade later, many of the initial pilot schools remain leading examples in their countries of how schools, teachers and students are utilizing new technologies in various ways to help support teaching and learning. While many of the challenges related to the successful and effective introduction of technologies in schools remain (the exploration of these challenges is of course a common topic explored on the World Bank's EduTech blog), a number of things have changed quite a bit.

The once strong links between such schools (and between the teachers and students in them), and the sense that they were essentially working laboratories where new innovations could be introduced and tested before later being considered as components of larger rollouts of large scale educational technology projects, have for the most part disappeared in many places, as the use of ICTs in education has become more mainstream across an education system and the uniqueness of the individual schools -- at least related to the fact they had computers and were connected to the Internet -- has gradually eroded.
In other words, what were essentially national leagues of schools doing innovative things with new technologies, with school leaders, teachers and students *networked together* to share experiences and support collaborative teaching and learning activities, ceased to exist in many countries in dedicated, structured, organized ways.

**What models exist today to help in establishing and maintaining a national league of innovative schools?**

And:

**Where such leagues exist, what value might there be in them connecting them with each other across borders so that students, teachers and school leaders can share experiences and pursue collaborative learning activities and research?**

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In 2015, whether or not you consider technology use in schools to be, in and of itself, an 'innovation' depends in part on where in the world you are located. Whatever one's definition of 'innovation' in education might be, there can be little disagreement that the increased availability of personal computing devices in the hands of teachers, learners and school administrators, connected to each other and to the Internet, offers the opportunity for increased sharing of information about innovative practices that are emerging in classrooms, for people to connect with each other as they conceive of and pursue new, innovative activities in support of various teaching and learning goals, and for such efforts to be documented and studied by researchers so that they might be more widely shared.

Within the United States, a group called Digital Promise supports a **League of Innovative Schools** for just such purposes. According to the Digital Promise web site:

"The Digital Promise League of Innovative Schools is a national coalition of school district superintendents that fosters collaboration between education leaders and entrepreneurs, researchers, and thought partners.

League members represent more than 3.2 million students in 57 districts and 27 states. Their experiences reflect the diversity and shared challenges of public education in America.

A vibrant ecosystem of educators, entrepreneurs, researchers, and thought partners working together on shared priorities, the League leads to better decision-making and greater innovation in learning and leadership practices. The League also aims to accelerate the pace of change in public education nationwide."

**Digital Promise** itself is an independent NGO authorized by the U.S. Congress in 2008 as the 'National Center for Research in Advanced Information and Digital Technologies'. Because it was constituted to work within U.S. borders, last year a
sister NGO, called Digital Promise Global was formed to help link this collection of innovative schools in the United States with networks of innovative schools in other countries. A disclaimer: I sit on the Digital Promise Global board as part of an effort to stay abreast of innovative practices in the U.S. that might be relevant to education systems in other countries. I also joined because I wondered about the potential to connect the League of Innovative Schools in the U.S. to similar networks in other countries -- and, where no such networks exist, or where such efforts are only in their infancy, to see where it might be possible to help build or strengthen organizational structures, activity models and efforts in other countries to network together teachers and students doing cool things with technology in ways that are useful and sustainable.

This is not meant to imply that, if you want to look for innovative activities in education using new technologies, you should first, or primarily, direct your gaze toward the United States. Far from it!

If you want to find a laboratory exploring the edge of what is possible with technology use in schools, connecting with and learning from experiences in a place like Uruguay, the first country where all students had their own free laptop and where schools have been connected (many of them via fiber) for a number of years, might be well worth considering, especially given the existence of Centro Ceibal, the new research center organized to help learn from many innovative efforts supported under Uruguay's pioneering Plan Ceibal.

Or how about a place like Korea, where the use of connected devices is near ubiquitous and where schools enjoy some of the fastest, most reliable Internet connectivity in the world? The concept of an 'innovative school' is actually a specific designation in Korea (not specifically linked to technology use). What opportunities might there be to link up such schools, or a subset of them, within a League of Innovative Korean Schools (perhaps supported by a group like KERIS, Korea's national ICT/education agency that has become a model guiding the development of similar agencies in a number of other countries), and possibly link them with counterpart organizations in places like Uruguay and the United States?

And not just those countries:
The European Schoolnet, a network of 31 ministries of education across Europe, has supported efforts to connect schools, teachers and students across the continent for purposes both mundane and cutting-edge, including through such efforts as eTwinning. Many large scale national efforts exist to roll out laptops, tablets and Internet connectivity to schools in various middle and low income countries -- might it be possible to set up leagues of innovative schools in those countries as well, in some cases building off and connecting with local institutions already supporting national educational technology projects? The Omar Dengo Foundation, for example, has been working to support innovative programs utilizing new technologies within Costa Rican schools for over two decades.

There are many worthwhile initiatives around the world supporting efforts to explore cross-border partnerships to promote and share 'innovative' practices in
education, such as the New Pedagogies for Deep Learning project. Groups like iEARN have supported exchanges between teachers and students around the world using new technologies for over two decades. *(Indeed: If you want to learn what works, and what doesn’t, when it comes to supporting students and teachers as they seek to collaborate with each other across borders, the iEARN community represents possibly your richest source of practical insight.)* Many vendors organize (and promote) collections of innovative schools and teachers who use their products and services. Some of these sorts of efforts last many years, others are more transitory.

*To what extent might a national league of innovative schools help support schools which participate in such efforts over time, to liaise or negotiate with other groups which might be interested in supporting 'innovative' activities in education over time, and to learn from them systematically?*

While models for such things will inevitably differ by country and context, the concept of a league of innovative schools is one of growing interest in numerous ministries of education around the world.

*Note: The image used at the top of this post of a red eyed tree frog ("I look and do things a bit differently from what is 'normal', are there others out there like me?") comes from Wikimedia Commons and was released by its author into the public domain.*
"Innovation!"

The buzz around this buzzword in education (the need for it, the celebrations of it, the challenges in catalyzing it) continues to get louder and louder, and the word itself seems to get invoked with increasing (almost de facto) frequency as part of discussions about the need for change.

Indeed:

How are we to meet and overcome many of the pressing, endemic, and sometimes seemingly intractable challenges facing learners, educators, education policymakers and education systems around the world if we aren't being innovative in how we define (and redefine) our problems -- and in how we propose to go about solving them?

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There are many groups, events and activities that seek to document, share knowledge about, analyze and assess various 'innovations in education' around the world. The annual World Innovation Summit for Education (WISE) in Qatar, for example, focuses explicitly on this theme. R4D's Center for Education Innovations does as well, in partnership with many international groups, including UNICEF (which has a special initiative on 'innovations in education' and whose much-lauded Innovations unit is for many of us a model for excellence within the international donor and aid community). The OECD's widely-read report last year on Measuring Innovations in Education seeks to offer "new perspectives to address th[e] need for measurement in educational innovation through a comparison of innovation in education to innovation in other sectors, identification of specific innovations across educational systems, and construction of metrics to examine the relationship between educational innovation and changes in educational outcomes."

Some observers may feel that this explicit focus on 'innovation in education' is overblown. We don't fund a lot of things sufficiently that we already know work, why don't we first concentrate on that stuff? Others may note that some 'innovations' in education promoted today have actually been around for decades, and thus perhaps no longer really qualify as 'innovations'. Sometimes the only 'innovation' in a particular 'new' approach is to utilize some new technology to do
pretty much exactly what was done before, but now 'digitally', and in a way requiring a power cable or batteries. (I am not too sure that many of these things are really all that 'innovative', but many people who keep sending me related proposals seem to be convinced that they are.) Still others detect in many discussions around the need for 'innovation in education' the guiding hand of 'corporate education reformers' and/or of technology vendors with products to sell, and, as a result of past experiences, ideological leanings, an inherent tendency towards skepticism or a satisfaction with the status quo, and/or political calculus, reflexively push back (if not indeed recoil).

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'Innovations in education' are about much more than just technology use, of course -- but there is also no denying that new information and communications technologies (ICTs) of various sorts continue to enable and catalyze many of the innovations that are being explored in the sector, whether they relate to e.g. teacher training; assessment; data collection and management; payment mechanisms; stakeholder engagement and transparency; or changes in the teaching and learning processes themselves; and whether they originate in the public, non-profit or corporate sectors (or even, as for example is the case of distributed communities of people working together to help build new software or educational content in ways that are 'free' or 'open', out of no traditional or easily definable 'sector' at all).

Sometimes the ICTs are hard to miss (as is the case with Uruguay's pioneering Plan Ceibal), and sometimes they are behind the scenes (innovative low cost private schooling schemes like those pioneered by groups like Bridge Academies, for example, depend heavily on the use of ICTs to promote efficiency and cut costs), but increasingly they are there. Many traditional groups active in advocating for funding efforts to help end extreme poverty and promote shared prosperity (the twin goals of the World Bank) are increasingly challenged to identify, make sense of and support the diffusion of 'innovations in education' in ways that are useful and efficient and cost-effective – and potentially, from time to time, even transformative.

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However one feels about the need for 'innovations in education', few would argue with the assertion that literacy is fundamental to one's success in school -- and in life. Despite great advances made in helping people learn to read and write over the past decades, however, UNESCO estimates that nearly 900 million people around the world cannot read or write a simple sentence. As part of its related efforts to help put a dent in these shameful figures, USAID (together with the Australian government and World Vision) recently announced the 14 winners of a competition to identify and celebrate "the most promising, creative and impactful solutions in literacy innovations". From innovative approaches to promoting mother tongue education using mobile phones (in Mali) and e-readers (in Cambodia) to fostering family and community engagement using radio (in Afghanistan) and working with children with special educational needs using software to create sign language graphics (in Morocco), new grantees under the All Children Reading
'Grand Challenge for Development' are tangible examples of the inventive ways that new technologies are helping with the acquisition of literacy skills among diverse populations around the world.

The objectives of prizes like those offered by All Children Reading are not only to provide some much needed additional funding to groups doing good work, but also to celebrate and highlight for others approaches that may be a bit out of the ordinary, shining light on what is possible in the hopes that others may be inspired to 'be innovative' in their work as well. The set of annual literacy prizes offered by the U.S. Library of Congress seeks to do something similar. (The nomination period for the 2015 Literacy Awards, including the flagship Rubenstein Prize and a special US$50,000 International Prize, will run until 31 March [pdf].)

Recognizing past innovations by making awards to the groups which have successfully implemented them, in the hope that doing so will help to spur others to think big, and perhaps 'out-of-the-box', is one way that groups are seeking to help promote innovation indirectly. Over the past decade a number of high profile 'prizes' related to education have sprung up around the world, some of them with rather eye-catching prize money attached to them. The first Global Teacher Prize, which colloquially refers to itself as the 'Nobel Prize for teachers', was awarded earlier this week, together with US$1 million, to a teacher at a ceremony in Dubai. The high-profile annual WISE Prize, administered by the Qatari Foundation, is also sometimes referred to as the 'Nobel Prize in education' (nominations for the 2015 WISE Prize are being accepted until 31 March). The nomination period for the latest UNESCO Hamdan Prize ("for outstanding practice and performance in enhancing the effectiveness of teachers") recently opened, one of a number of regular education-related prizes which UNESCO administers (including one related to ICT use in education).

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Another more direct and targeted approach to help spur innovations in education through the use of a prize of some sort is to set specific targets related to some larger developmental goal, and then to offer prizes to groups that are able to meet these targets in the future. As with global education prizes more generally, 'prizing competitions' of this sort have also mushroomed in recent years.

This approach is consistent with what All Children Reading is attempting to do with two of its other prizes: one focused on identifying innovative approaches to using Technology to Support Education in Crisis and Conflict Settings and another to help with Tracking & Tracing Books destined for early-grade classrooms and learning centers in low-income countries. (A full list of grants and prizes associated with the All Children Reading initiative is available on the All Children Reading web site.) Perhaps the most audacious effort of this sort, however, is the US$15 million Global Learning XPRIZE, a "competition that challenges teams from around the world to develop open source scalable software solution that will enable children in developing countries to teach themselves basic reading, writing and arithmetic within the 18 month competition field-testing period." Announced alongside the UN Global Assembly last September, this latest in a series of high-profile 'XPRIZEs' has
engendered a **fair amount of excitement** ... more than a little confusion ... and, in some quarters, a **fair amount of criticism** as well (these things are not mutually exclusive, of course).

As per related press announcements and the xprize.org web site, "The Global Learning XPRIZE challenges teams from around the world to develop open source and scalable software that will enable children in developing countries to teach themselves basic reading, writing and arithmetic, empowering them to take control of their own learning and ultimately their future". More concretely: "Teams will compete in a multi-stage competition that test for specific criteria: Ability to measurably increase the learning of children with limited access to schooling. Creation of a design that is easy to use and engaging for children, so they can operate it alone and/or in self-organized groups. Creation of open source software that makes marked improvements to existing technology."

Could a Global Learning XPRIZE help 'crowd in' some non-traditional actors -- especially those from the technology sector -- to help explore new approaches to meeting longstanding challenges related to literacy, in partnership with key groups with long experience and knowledge in working with some of the most difficult target groups, which traditionally are not considered in any prominent way as users of new technology products and services?

(How many robustly engineered, commercial-grade technology products and ICT-enabled services are explicitly designed to target the needs of low literate or illiterate users in poor, remote communities around the world? Traditionally, the answer to this question has been: *Not many.*)

If 'business as usual' isn't getting us where we need to go in many education systems around the world, for a variety of reasons, might an attempt to catalyze 'business unusual' be worth pursuing?

This is what the XPRIZE folks are keen to explore. A follow-on post will look at this effort in more detail.

You may also be interested in the following posts from the EduTech blog:

- Educational technology and innovation at the edges
- ICTs and Literacy (the old fashioned kind)
- Bollywood Karaoke and Same Language Subtitling to Promote Literacy

*Note:* The image used at the top of this blog post of a bicycle with a modified front wheel ("an innovation supporting a revolution?") comes from Flickr user Andy Mitchell via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 2.0 Generic license.
Almost twenty years ago, the World Bank president was scheduled to visit some schools in Uganda. Around that time, the Bank was exploring the possibility of investing in videoconferencing to connect its offices, and those of its counterparts in government ministries, to each other as a way to promote more regular dialogue (and, it is probably worth noting, to save some travel costs as a result).

Wouldn't it be excellent, Jim Wolfensohn asked, if we could somehow connect these kids in Uganda to schools back in the United States in some way using the Internet so that they could talk to each other and exchange ideas -- can this be done?

A World Bank colleague (who was soon to become my boss) said, 'yes sir, absolutely, we can do this.' At the time, it turned out that he actually had no idea how to get this done ... but he and a few other bright people eventually figured it out, the schools were connected, and Ugandan and American kids talked with each other via video in real time, more or less successfully. (Video-chatting over the Internet back in 1996/1997 was an often frustrating endeavor, but, given enough energy and more than a little luck, it did -- kind of, sort of, sometimes -- work.) Out of this small 'success' was born the 'school-to-school initiative', which soon was renamed the 'World Links for Development' program and which over the next decade worked with ministries of education in 20+ middle and low countries around the world to help connect schools, teachers and students to the Internet -- and to each other.

Obviously, much has changed from 1996 to 2015. Information and communication technology itself has, of course, changed dramatically: There is more of it; it is more powerful; it is faster; it is cheaper; it is available to many more people; and many more people know how to, and do, use it as part of their daily lives. Just because the tools to make connections between teachers and learners across national borders have improved a lot, however, doesn't mean that it is easy to actually make and sustain such connections over time in ways that are useful -- and sometimes even exciting.

Because of my experience with World Links (and a number of other similar efforts), I am often approached by groups looking (to quote from one related representative
email inquiry) to 'connect teachers and students around the world in order to engage in enriching collaborative learning projects together to promote global peace and understanding and develop 21st century skills and competencies'. To the extent it might be of interest to anyone (and just possibly to save myself and others the time it takes to meet to discuss such things in person or over email), I thought I'd share some hard-won lessons and perspectives about what seems to work (and what doesn't) when it comes to connecting teachers and students around the world to each other so that they can achieve whatever it is they hope to achieve as a result of such connections.

I don't pretend to be an 'expert' on this stuff (although I have learned from many folks whom I think probably deserve such a label), and no doubt there is at least one potential exception to every rule of thumb or guideline or piece of advice I present below. The list of things discussed here makes no claims to comprehensiveness. That said, hopefully there is something here that some of you might find useful -- or which provokes you in useful ways.

**Ten comments, questions and perspectives on connecting students and teachers around the world to each other to facilitate 'virtual exchanges'**

1. **Many groups have lots of experience in facilitating student and teacher exchanges over the Internet**
   If you are looking to help facilitate conversations and learning activities between students and teachers using the Internet -- this sounds great! One thing to consider: Lots of other groups have done, and do, this too. Some do this well (like iEARN, which despite the crazy capitalization in its name has been a leading organization in this area for over two decades), and some admittedly not so well, but there is a wealth of experience you can tap into. You might wish to invest a little time and effort into learning about what works, and what doesn't, from such groups, who are often very open in sharing information. You may even want to partner with a few of them as you get started.

2. **Why are you connecting?**
   This may sound like a(n overly) simple question, but I often find that many groups seeking to support things like 'connecting students to each other over the Internet' wade into such waters not only without a clear idea of what exactly they want to do, but also of why exactly they want to do it. Connecting just for the sake of connecting, as might occur in a short 'pen pal' sort of interaction, can be a valuable experience, but such connections might, by their very nature, be too ephemeral (or even superficial) to have sustained, long-lasting value over time. This is not to contend that such quick connections and interactions don't have any value, of course -- **absolutely not**! Rather, it is just to point out that exchanges of that sort are only one potential type of interaction possible to catalyze and support between students (or teachers) online. If you hope to utilize such connections to help promote the development of some of what are often referred to as '21st century
competencies' (such as those identified as 'goal 4.7' in the UN's proposed new 'sustainable development goals'), you might need to consider more than a very short, time-bound exchange of information. Whether your virtual exchange is meant to serve as a 'side dish' (complementing some other ongoing or planned educational activity) or the 'main course' (where the exchange itself is the focus of what you are doing), having clarity about your reasons for connecting will help provide useful direction as you plan for whatever it is you end up doing.

Indeed:

3. Your reasons for connecting will influence the nature of the connection
Many groups actively look to utilize the Internet to connect teachers and students to each other from different countries as part of an effort to 'promote great peace and global understanding'. A question: If, by helping to catalyze and support a virtual exchange between students and teachers in different parts of the world, your goal is to promote 'peace and understanding', do you want to make the exchange about that ... or about something else in order to develop and nurture the sorts of connections that could, as a by-product, lead to greater 'peace and understanding' (whatever that may mean to you)? If you are explicit about promoting 'global understanding', you may tend to attract certain types of folks and promote certain types of interactions. There is nothing wrong with this, of course. But it might be worth considering whether such goals might be met by focusing on something *else* (joint scientific exchanges, for example, or collaboratively writing a report about a health or environmental issue common to both sides), targeting teachers and students with other interests, where the promotion of 'peace and understanding' across borders might be a potential by-product of such exchanges or collaborations.

4. Scheduling is non-trivial!
Especially as you seek to establish and maintain connections across borders, complications related to differing school calendars and curricula, if not anticipated and managed, can present significant challenges. When a school in one country is in session, another may be on holiday. What students in country X learn when they are 12 years old may be first introduced in another country's curriculum for 15 year olds. Even if a topic is taught in the last year of primary school in two countries, the sequencing may be quite different. Time zones are also one (obvious) potential issue: It is hard to Skype with people in another hemisphere if they are asleep. Even where curricula are roughly similar, school calendars are generally aligned and time differences are manageable, holidays, exam periods and basic differences in instruction periods each week (in one school a topic may be taught twice a week where in another it is taught daily) can make coordinating schedules quite difficult in practice. In my experience, nitty-gritty scheduling issues are often a *much* bigger challenge in practice than they may first appear.

One way to get around such scheduling challenges is to ...

5. Make it all extra-curricular
Given all of the challenges with scheduling, and age cohorts, and alignment with
curricula -- and perhaps with student interest and access to technology as well -- it might be most prudent to consider anchoring such exchanges within extra-curricular activities outside of normal school hours. Doing this has obvious drawbacks, of course, but it might be the most practical approach in many circumstances. Classroom teachers and students may (unfortunately) be judged largely (or even in some places solely) on various high stakes exam results, and where cross-border online connections are not seen to directly support preparation for such exams, they may be hard to maintain, or even justify, within a formal classroom environment and school structure. If you make participation something *extra*, and pursue it outside of normal class hours (after school, during break or free periods, even, as possible/appropriate, in the evening or on weekends when students are at their homes), the exchange might be possible.

6. Connecting classrooms to classrooms versus one individual classroom to another single classroom
Connecting to classrooms, students and teachers in other parts of the world can be exciting -- and very difficult to do successfully. This is especially true when groups on both (or all) sides do not know each other and have no shared history of working together -- especially when they have never met in person. One important approach that can help support and sustain connections at a distance is to simultaneously pursue more 'local' connections as well. For example: A few teachers and classrooms in a school or local community can join together in reaching out to counterparts in some other place. This provides teachers on each end with a local peer network upon which they can rely for guidance and support. If for some reason a connection with a distant group falls through, a project can still proceed 'locally'.

Related to this ...

7. Global vs. national (or local) connections (and how they might be related)
Connecting students and teachers in different schools together in some way using the internet can be a very rewarding experience. It can also be quite difficult to make happen, even between schools within the same education system, studying the same thing, and where students/teachers of similar backgrounds and experiences are linked with each other. One of the reasons to attempt connections, of course, is precisely to help bridge (real and/or perceived) differences of various sorts (geographic, linguistic, national, socio-economic, ethnic, gender, religious, etc.). That said, such differences can complicate such connections in all sorts of (understandable) ways. With this in mind, it might be useful to consider connecting locally to support cross-border connections.

In my experience with the World Links program, we often found that (for example), as interested as kids in Accra might be in connecting with students in Chicago, they were often actually *more* interested in connecting over the Internet with their counterparts in schools in Cape Coast or Kumasi with whom they might otherwise have little opportunity to interact. (For those who don't recognize the names of some of these cities: Three of them are in Ghana.) Connecting students and
teachers across Ghana together, and then collectively pursuing online exchanges with similar groups in the United States, was in some ways easier to pull off than just trying to connect two schools across international borders. And: The national connections persisted long after the international ones weakened.

8. Language will be a challenge
Part of what makes cross-border connections between students and/or teachers novel, fun and adventurous is the language barrier. (There can sometimes be language barriers even where both groups nominally speak the same language. 'Two countries divided by the same language' is how George Bernard Shaw once rather wittily characterized the United States and England. The same might be said for South Africa and Singapore, or even, as a joking co-worker from Milan once told me, for different parts of the same country, including her native Italy!) Online language translation tools have come a long way in recent years, and can be invaluable aids in bridging language barriers. As anyone who has used them knows, however, the results generated through the use of such tools can be far from perfect in many cases. Where real-time communication is required (in chat rooms, for example, or using videoconferencing), time delays due to translation need to be factored in.

One common approach utilized in many online or virtual exchanges is for most communication to be routed through teachers, who may be more likely to share a common language than might all of the students in both classrooms who might be connected. (There are other reasons to consider routing communication through teachers; more on that later.)

One piece of advice: If you are looking to connect to a classroom in another country so that students in your classroom can practice using their foreign language with native speakers, you might want to consider what your 'partners' may get out of such exchanges. As interesting as it might be for your third year French-as-a-foreign-language students to practice their rudimentary linguistic abilities with native speakers in Lyon or Dakar, the native French speakers on the other end may quickly lose interest in such communication. This is not to say that exchanges for the purpose of practicing foreign languages are inappropriate, or likely to fail -- not at all (or at least, not necessarily). It is just to consider reciprocity, and what incentives there might be for groups on both sides of exchanges to sustain them successfully.

9. Consider supporting virtual connections through face-to-face interactions
Many schools in Europe have enjoyed productive, and sometimes quite long-term, online connections with each other across national borders. The work of the European Schoolnet, and notable efforts like the eTwinning initiative of the Erasmus program, have been pivotal in this regard in many instances. So too have been a number of other programs which have supported (at admittedly quite high costs in many cases) bringing students and teachers together in personal to visit each other’s schools. As comfortable as people are getting with making and sustaining online connections, such connections are often made much stronger where groups
10. Build off existing relationships and interests, initiatives and events

When connecting globally, one approach to consider is to include a diasporan community on one side. Examples of this could include connecting a school in Sydney with large numbers of first generation immigrants from China with a school in Shanghai, for example, or a community in Sao Paulo with many students whose families originally hailed from Japan with a school outside Tokyo. There may be existing linkages between such groups facilitated by groups outside the education system that can help with this. Another is to link with existing Sister Cities relationships, which sometimes have existing mechanisms in place to help facilitate connections, but which are in need of people to connect, and reasons to connect them. Yet another approach can be to link in some way with a large international large event (a sporting event like the Olympics or the World Cup, for example) which brings together or interests people from different countries at the same time. Entering various online competitions can be a way for a school to meet potential collaborators and partners, and provide a rational for such a collaboration. Sometimes schools can leverage the fact that an international business has operations in both of their local communities for support in making and sustaining their connections and virtual exchanges.

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No doubt many others have additional advice or suggestions (and/or may disagree with some of the things I have said here). If so, adding a comment below is most welcome! I have a few more things to share as well. To that end, a follow-up post next week (I figured that this one had already gone on too long) will offer ten additional comments, questions and perspectives on connecting students and teachers around the world to each other to facilitate 'virtual exchanges'.

Note: The image used at the top of this blog post of two hands with interlaced fingers cradling a mobile phone ("technology at the middle of a human connection") comes from the Wikipedian Ayesea11 via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license.
A few years ago I was visiting a high school in central Russia and stopped by a chemistry class near the end of the day. It looked, more or less, like a chemistry class that one might see in many places around the world: kids in white lab coats pouring stuff into beakers, taking measurements and scribbling results on their notepads (and then doing the same thing again, and again).

The students were hurrying to collect their data so that they could compare them with other groups in the class -- and, it turned out, with the results 'from Toronto'. 'Toronto?' I asked, a little confused. 'What do you mean?'

I was told that the class was linked via Skype to a chemistry class in a high school outside Canada's largest city, which was doing the exact same experiment. 'Go have a look', one of the Russian kids said, nodding his head toward a computer monitor on a nearby table that showed a row of beakers much like those on the tables near me. The Russian student turned on the nearby microphone, called out a name ... and two heads popped up on the screen, attached to bodies halfway around the world. The students greeted each other, made a quick joke about the Maple Leafs and Ak Bars (the respective local hockey teams), and then started discussing the experiment.

The teacher later told me that she had been communicating with teachers in other countries whom she had found on the Internet and had been using Skype for about a year to connect to some of their classrooms, in order to demonstrate to her kids how science is really a global language, and how important it is to share your findings with the whole world. The local education officials who were with me on the school tour got very excited about all of this -- they had never seen such a thing. Yes, when I think about it, it is pretty neat, the teacher responded. Despite the occasional communication problem or technical glitch, however, her students really didn't really think this was a very big deal. Many of them were used to playing videogames with kids in other countries over the Internet already, she said, and to them this was in some ways just more of the same.

A post on the EduTech blog last week offered ten comments, questions and
perspectives on connecting students and teachers around the world to each other to facilitate such 'virtual exchanges'. Here are ten more:

[As I noted when presenting the earlier list: I don't pretend to be an 'expert' on this stuff -- although I have learned from many folks whom I think probably deserve such a label) -- and no doubt there is at least one potential exception to every rule of thumb or guideline or piece of advice I present below. As with the earlier list, I make no claims to comprehensiveness; some important things are no doubt discussed incompletely, and others perhaps not at all. That said, hopefully there is something here that some of you might find useful -- or which provokes you in useful ways.]

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Ten (more) comments, questions and perspectives on connecting students and teachers around the world to each other to facilitate 'virtual exchanges'

1. The best predictor for 'success' is prior experience (even if it was a 'failure')
   It may be obvious, but it may be worth stating nonetheless: The best predictor of a successful online exchange is often the fact that at least one of the groups involved has successfully done something similar in the past. With this in mind, pairing 'experienced' and 'inexperienced' schools or teachers with each other where possible can increase the odds for a successful online exchange. Even where a previous attempt 'failed', having attempted something previously can provide invaluable and highly practical lessons which might make a subsequent more likely to 'succeed'.

2. Some common categories of virtual exchanges
   There are, generally speaking, three general categories into which online student/teacher exchanges can be placed:
   - Project-based exchanges ("let's do this together") typically focused on a specific, pre-defined activity or interaction.
   - Thematically-based exchanges ("we are both studying something similar, let's team up / share as appropriate along the way) often times are extensions of activities already occurring in classrooms.
   - School-based exchanges ("we're sister schools, so we should do something together") often result from administrative or cultural connections between schools which are geographically far apart but which wish to collaborate on something together.

While there are many common features of exchanges of these sorts, there are important practical differences as well, with often very specific practical consequences.

3. Policies, and firewalls, can present real challenges
   Connecting with other schools across the Internet can often push up against
existing school policies which didn't envision such sorts of interactions when they
were initially put into place. Where, for example, teachers are prohibited from
interacting with their students on social media, what happens when the easiest tool
for interaction with a distant partner is ... Facebook? And: What if one school
wishes to collaborate via Facebook, but that social networking site is blocked in the
other school? One perhaps surprising reality observed in some efforts to connect
teachers and students with each other online is that those in schools in more
'advanced' countries may have more difficulties in making such connections
because there more rules and technical barriers (e.g. school firewalls) in place than
there are in education systems where Internet use in schools is comparatively new.

4. When it comes time to communicate, always have a back-up plan
The opportunities to connect students and teachers with each other across
borders have never been better than they are today -- but the technologies can still
sometimes let you down. In addition, human factors (somebody on one end of an
exchange forgets to do something, or gets sick, or gets upset) can disrupt even the
best plans. Having a back-up plan (a mobile phone number or Twitter account, a
pre-established secondary time/method to connect, a lesson plan that will work
with students when connections are not possible) can be important to keep things
going when something 'goes wrong'. And something will almost always 'go wrong'
at some point.

5. Go where people are -- don't make them come to you
One trap that some groups seeking to support online exchanges between teachers
and students across borders is to first build a specialized web site or online tool to
facilitate such exchanges. This may work ... but it can be a rather expensive and
speculative endeavor. It might be more useful to utilize existing tools already in use
in schools (e.g. email) or by teachers and students (e.g. Facebook, WhatsApp) or
existing messageboards/chatrooms set up by others to find and initially connect
with other groups than to expect them to find you and use some new tool you have
developed for that purpose. (Some NGOs, e.g. iEARN, help animate networks of
teachers looking to connect with others online; there are also companies that can
broker and support such connections for groups willing to pay for such services.) It
is often easier to dance with someone if you go to where dancing is already taking
place than to build your own dance floor in your basement. The precious time and
energies and funds you spend developing and maintaining new technology tools
might be better spent in supporting students and teachers as they attempt to utilize
the tools they already have, and know how to use, when interacting with each
other.

6. Consider running everything through teachers
Given logistical and technical challenges, and a desire to make sure virtual
exchanges have 'educational value', you may wish to structure your online virtual
exchanges in a way that channels all or most communication through teachers on
both sides. Some people will object to this, maintaining that direct communication
and interactions between students should be a central feature of any virtual
exchange. I understand and sympathize with such objections. I am just being
practical here – especially for groups doing this sort of thing for the first time.
School administrators and parents may object to, or at least be very hesitant about, connecting students to other students whom they don't know over the Internet. Having teachers fully 'in charge' can help alleviate related concerns. Running communications through teachers can also make scheduling and communication much easier (especially communication across languages), and can provide useful structure to online interactions. It can also lessen (but not fully remove) the likelihood that students may do something 'inappropriate' which may offend other parties -- or embarrass themselves. Your end goal may be to have students interacting actively, and directly, with each other as part of an online virtual exchange across borders. But it might be nevertheless worth asking: Do we start with those sorts of interactions right away, or build towards them over time?

*Even if you do this, however ...*

**7. Kids will find ways to connect with each other**

Kids are already connecting with each other across borders in lots of ways (via games, YouTube, Instagram, etc.) over the Internet. When you set up an exchange between classrooms, expect that students may well Google each other, look each other up on social networks, meet on message boards or via mobile gaming apps etc. and make connections outside the scope of the official, planned methods of interaction. The fact that some or all of these things may be 'blocked' in schools may not keep students from finding ways around such blocks (kids can be rather inventive in that way). With this in mind, it can be useful to anticipate, and lay out some guidelines related to such (potential) interactions.

**8. Stuff will go wrong**

Like adults (including their teachers), kids occasionally say and do stupid things online -- sometimes with the best of intentions, sometimes with malice. The technology to facilitate virtual exchanges may not always work -- or work as planned. Recognizing where, how and why things aren't working, and making adjustments as a result, can be an important part of any learning process. This is the nature of communication and collaboration and working together, of course. Assume that something will go wrong during the course of a virtual exchange -- even if you don't know what that something may turn out to be.

**9. How you end is more important than how you begin**

While the excitement around virtual exchanges usually peaks in the early stages, how the exchange ends may be what is most important. While a lot of effort is often expended planning for how a virtual exchange will kick off, oftentimes insufficient attention is paid to *how to end it successfully*. Making an exchange explicitly time-bound from the very beginning can help ensure that sufficient attention is given to the end stage of a virtual exchange. Planning your 'exit strategy' (whether that exit happens at the time originally scheduled, or sooner as a result of some challenge or issue that reveals itself along the way) is always a good idea.

**10. Measuring impact**

What is known about the 'impact' of online virtual exchanges between students,
teachers and classrooms? As more and more schools around the world are connected to the Internet, as more and more teachers and students are connected to the Internet in their daily lives, and as technological advances help expand our horizon of what is possible, we should see more rigorous research that can inform answers to such a question. Unfortunately, this remains an under-examined topic for researchers. For those promoting and supporting such exchanges and connections, knowing and articulating in advance what you want to achieve as a result of engaging in some sort of 'virtual exchange' with students and teachers in other parts of the world can help you assess the 'impact' of what you have done. How can you measure the impact of making online connections between classrooms in different parts of the world? The answer will depend, of course, on many factors, including your goals for pursuing this sort of thing in the first place, the nature of the connection and interaction, and your time horizon. But your first step should be to start asking a lot of other related questions.

*Lastly: Prepare to be surprised!*

One common feature of pretty much every attempt to connect teachers and students to each other across national borders using the Internet in which I have been involved in some way has been the element of *surprise*. Something inevitably happens that no one expects. Surprise and serendipity can help spark student creativity -- and indeed can help enable some of the most transformational learning activities. Virtual exchanges may be difficult to do well, but for groups that are successful at them, literally a whole world of new teaching and learning opportunities can become available.

*You may also be interested in the following posts from the EduTech blog:*

- Using the Internet to connect students and teachers around the world for 'virtual exchanges'
- Establishing and connecting leagues of innovative schools around the world

*Please note:* The image used at the top of this blog post of two hands clasped together ("connecting") comes via [Wikimedia Commons](https://commons.wikimedia.org). It is a work of the National Institutes of Health, part of the United States Department of Health and Human Services. As a work of the U.S. federal government, the image is in the [public domain](https://en.wikipedia.org/wiki/Public_domain). Rhoda Baer (Photographer) grants anyone the right to use this work for any purpose, without any conditions, unless such conditions are required by law.
Edtech and MOOC Times in China
by Michael Trucano
#8: originally published on Tuesday, 12 May 2015 see

If you want to see the future of online education, lots of people will tell you to head out to Silicon Valley or New York City or Cambridge (either of them) or London -- or to some other ('highly developed') place that tends to be written about by the (English-speaking) press. Fair enough: You can find lots of cool stuff going on in such locations.

I tend to think that it can be even more interesting to talk with local groups and people exploring 'innovation at the edges', especially those who are trying to solve educational challenges in places outside of the 'highly developed industrialized economies' of North America and Europe, Australia and Japan. If you believe that some of the most interesting innovations emerge at the edges, talking with NGOs, start-ups and companies in places like Nairobi or Cape Town, Mumbai or Bangalore, Jakarta or Karachi, who are trying to address educational needs, contexts and challenges of a different nature and magnitude than one finds in, say, Germany or Canada or Korea, can be pretty eye-opening. Observing what is happening in 'developing countries' -- where, after all, most of the world lives -- can provide a quite different perspective on what the 'future of education' might look like. This is especially the case in places where people are not trying to port over educational applications, content and experiences developed e.g. for desktop PCs and laptops, but are rather pursuing a mobile first approach to the use of technologies in education.

If you want to get a glimpse of what the (or at least "a") future of online education might look like in much of the world, you might want to direct your gaze to consider what's happening in a place that combines attributes from, and shares challenges with, education systems in both 'highly developed' and 'less developed' countries, somewhere with a significant urban population as well as large populations in rural areas. A place, in other words, like ... China.

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China is a rather big place, of course, and so telling someone to 'look to China' may not be all that helpful. While I have no idea if it is representative of what is happening in other places across the country, I'll be more specific, for the sake of argument here: If you want to see one possible future of what online education...
("edtech") might look like, you could do worse than to visit one building in the Haidian district of Beijing. The Zhongguancun area of Haidian, known as China's 'Silicon Valley', features offices for over 12,000 high tech companies (including such well known firms as Baidu, Sohu.com and Lenovo). A few short blocks from the main gates of Peking University, the Zhongguancun MOOC Times Building contains offices for almost three dozen companies active in diverse parts of the 'online education economy', including firms creating digital educational content and apps; providing online education services (test prep and foreign language instruction are big business in China); developing tools and platforms upon which other companies can build their online education offerings. The MOOC Times Building (yes, that's really what it's called!) also houses the Mobile Internet Education Industry Alliance and two incubators for online education startups (which, for what it might be worth, look a lot like those I have visited in other parts of the world ... although one staple piece of furniture that I see at many startup incubators in other countries -- a ping pong table -- was for me curiously absent). You can also find very small startups -- and entrepreneurs considering founding their own startups -- occupying open seats at long tables in various offices.

Last week the Zhongguancun MOOC Times Building hosted a two-day event co-sponsored by the World Bank, the China Institute for Educational Finance Research (CIEFR) at Peking University and the Chuangkebang Mobile Internet Incubator that brought together a few hundred representatives from government, academia and the private sector to share perspectives and lessons -- and more than a few challenges and questions -- as a result of emerging experiences in China related to technology use in education. While the structure itself has been around for a while, it was renamed the 'MOOC Times Building' less than a year ago. The re-branding (in June) was in recognition of the current popularity that 'MOOCs' enjoy across China. While the word is the same across international borders, it means something different in the Chinese context. As Justin Reich (who participated in last week's event in Beijing, sharing insights from recent research from the HarvardX and MITx MOOC initiatives) notes in a great blog post that appeared this week on EdWeek, "In China, the acronym MOOC has become untethered from its original meaning: it still means large-scale online courses, but it also means anything related to online learning or education technology. In China, all of edtech got MOOC'd." That is not to say that 'traditional' MOOCs are not in evidence: Both edX and Coursera are very popular in China, and local equivalents are emerging as well. (I was kind of hoping that there would be a specific word for this in Chinese that I could use that going forward, and so not have to utter the unfortunate acronym 'MOOC' ever again, but alas, the Chinese just use the English word.)
Over the past year, the operators of the MOOC Times Building have been aggressively trying to turn it into ground zero for the online education industry that has been growing rapidly in Beijing. In common with many other industries, and despite that fact that the Internet was supposed to help bring about the 'death of distance', many Chinese edtech firms and entrepreneurs increasingly desire to be located in close proximity to each other, for a number of reasons: to network with and learn from each other; to benefit from shared investments in infrastructure and tools; to develop a critical mass that can attract potential partners, funders and employees; etc. The dynamism and excitement of many of the young online education firms I visited -- most of which are only a few years old, some only a few months! -- was clearly apparent. The variety of products and services they offer is quite impressive, and included: Online test prep services to help people prepare for professional certifications in fields such as construction, accounting and healthcare. A search engine dedicated to online learning content. Online training for car repair technicians and teachers. Software to help utilize toys as part of coding and education robotics instruction. And: A really cool set of online tools to enable teachers and students (or anyone, really) to create their own animations in support of their teaching and learning. Some of the offerings seemed quite basic to me. The building itself maintains a shared set of video production studios which its tenants can use at subsidized rates as they develop their own digital learning content. (For better or worse, video lectures are alive and well -- and apparently quite popular -- with millions of learners across China.) Other firms were pressing up against the leading edge of what I expect the market may currently bear. Who knows how many of these products and services (and companies) will still be around a few years from now, but the potential for iterative improvements, and innovation, seemed pretty clear to me. However one feels about the oft-cited Silicon Valley mantra **fail fast**, developments in the online education sector in China seem to be moving forward at a rapid pace.

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Back when I was taking introductory Chinese language classes a few decades ago, the standard greeting I learned was, 'Have you eaten yet?' Last week in Beijing, however, by far the most common opening line I heard was, "Do you have WeChat?", referring to the **massively popular mobile messaging service** whose use is seemingly ubiquitous among education officials and entrepreneurs in the Chinese capital. **Times, as they say, have changed!**
This is a growing, and evolving, industry. As a recent round-up of financing deals for edtech companies around the world from Audrey Watters notes, "half of the top funding rounds so far this year have gone to Chinese online education companies." According to data shared at the Beijing event by an analyst from TAL Education Group (a large Chinese education company that is listed on the New York Stock Exchange), the magnitude of investment in online education companies in China is fast approaching what one sees in the United States, traditionally the largest and most 'developed' edtech market. The figures cited, which were attributed to a variety of American and Chinese industry research groups, showed that U.S edtech investments grew a heady 9% in 2014 from its 2013 levels. This growth has led more than one person to wonder if the U.S. is experiencing an 'edtech bubble'. Whether or not this is the case, this growth pales in comparison to what is happening right now in China: Investments in Chinese online education firms grew by 700% (!) over the same short period, to a total of US$1.09bn, closing in on the U.S. figure of US$1.36bn. According to TAL's research, there were a total of 692 online education companies in China in April 2014, and this figure grew to 1,018 companies in May 2015. Key areas of activity include educational content and learning applications focused at the pre-school, K-12 and vocational education segments, as well as online services related to study abroad (there is great demand for this in China) and a variety of extracurricular learning-related activities. Companies are increasingly seeking to monetize many previously free products and services, and are also taking first steps in trying to sell into public schools (a huge potential market, but one with different barriers to entry than the after-school and tutoring markets, where it is possible to sell directly to consumers). A trend to target online education products and services to younger and younger learners (and their parents) is apparent, and is leading firms to wonder whether lessons learned from serving older students are still relevant when it comes to younger learners, or if new approaches need to be explored.

Important questions around educational equity are becoming louder, given that affluent/urban students remain the primary focus of most online education firms, although there are groups beginning specifically to target their products and services to rural areas. (One notable example is the Sunshine Library Rural Digital Education Initiative, which will be the subject of an upcoming EduTech blog post.) That said, questions around online education and 'equity' take on a different flavor in China than they do in, say, the United States and many other Western countries, where some critics have argued that adoption of MOOCs may lead to a two-tiered system of education, with poor kids are resigned to taking 'inferior' online courses with thousands (or millions) of their peers, while rich kids benefit from higher quality, face-to-face 'elite' educational experiences. When I posed a related question about 'MOOCs and equity' to three prominent Chinese academics during a discussion session at last week's event in Beijing, I was told that I had things exactly backwards. MOOCs and online education are actually a force *for* greater equity in China, I was told, not less. The quality of rural education (in the west, in the northeast) is far lower than in the developed urban areas along the eastern and southern coasts of the country, and so any means to expand access for rural students to the type of educational experiences of their counterparts in the big cities is a good thing. At least that is how the argument was put to me. (For more
on this topic, have a look at Justin Reich's insightful related blog post.) It is worth noting that the standard pedagogical model valued in schools across China, and by parents -- a teacher lecturing to a class -- is well suited to being digitized and delivered electronically to schools in rural areas. My point here is not to question this model, nor the belief in its effectiveness, but rather to highlight that opinions regarding the value of different approaches to 'online education' can differ dramatically, depending on where you are in the world.

As Chinese online education companies venture out of their hyper-competitive domestic market into the rest of the world, in some cases moving into developing economies where Chinese firms in other sectors and overseas developmental assistance have already made significant inroads, one should not be surprised if models, tools and approaches of online educational technology use in China find roots in other markets and education systems. The future is already here, the science fiction writer William Gibson has famously said, it's just not evenly distributed. No doubt there will be multiple 'futures' for online education, as for education in general, which emerge over time. If you're not paying close attention to what's happening in this regard in China today, however, you may be missing important clues as to what is going to happen in many other places around the world tomorrow.

You may also be interested in the following posts from the EduTech blog:

- Educational technology and innovation at the edges
- A 'mobile first' approach to educational technology
- eLearning, Africa, and ... China?
- ICT and rural education in China

Note: The image at the top of this blog post of a statue of an ox in Jiangsu, China ("The Chinese word for MOOC is ... MOOC") comes from the Wikipedian Jayrod422 via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license. The picture of the lobby of the MOOC Times Building comes from me and is released into the public domain.
Key themes in national educational technology policies
by Michael Trucano
#9: originally published on Friday, 15 May 2015

The World Bank is concluding an analysis of over 800 policy documents related to the use of information and communication technologies (ICTs) in education from high, middle and low income countries around the world in order to gain insight into key themes of common interest to policymakers. This is work is part of the institution’s multi-year efforts under its Systems Approach for Better Education Results (SABER) initiative to provide policy-relevant guidance for education decisionmakers in a number of policy 'domains' (including areas such as workforce development; school finance; teachers; management information systems; equity and inclusion; and student assessment).

This analysis of ICT/education policies under the SABER-ICT research initiative suggests that there is a set of eight common themes which are, in various ways, typically addressed in such documents. The specific related policy guidance related to each theme often differs from place to place, and over time, as do the emphasis and importance ascribed to this guidance. Nevertheless, some clear messages emerge from an analysis of this collected database of policy documents, suggesting some general conventional wisdom about 'what matters most' from the perspective of policymakers when it comes to technology use in their education systems, and how this changes as ICT use broadens and deepens.

It should be noted that what appears to matter most to policymakers, at least according to the official policy documents that they draft and circulate related to ICT use in education, may not in fact be what actually matters most from the perspectives of students, teachers, school leaders, parents and local communities, politicians, local industry, academics, researchers and other various key stakeholders and beneficiaries.

Whether one agrees with apparent policy intent or not, being able to identify such intent can be a catalyst for important discussions and analysis:

*Is this really what’s most important?*
*Does this policy rhetoric match our on-the-ground reality?*
If not:

*What can or should be done?*

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It is an abiding (and fully understandable) conceit of many governmental policymakers that ‘policy drives practice’. This may or may not be true, depending on the nature and substance of a specific policy and local context. When it comes to the development and use of new technologies, the absence of related policy guidance or directives can sometimes enable useful action and activity in certain areas -- especially those which are changing quickly, as can often be the case when new technologies and technology-enabled actions are being introduced and evolving rapidly.

Useful policies and policy guidance can facilitate, enable and encourage certain desirable actions and outcomes; inappropriate or 'bad' policies can do the exact opposite. In some cases, 'getting out of the way' can be a relevant policy choice. Whether in the end this is a result of reasoned and deliberate decisions by a policymaker, or occurs as a result of (for lack of a better term) governmental neglect or inattention, there is no denying that, if and where people are provided the space, tools, incentives and means to innovate, they may just do so. Whether such actions or innovations have positive or negative effects (and often they of course have *both* positive and negative effects), policymakers can play key roles in amplifying, inhibiting, or re-directing such effects to help serve various larger policy goals and objectives.

It is an acknowledged truth in many quarters that, even within a particular educational reform process, or indeed where no reform process is on-going, *the pace of technological innovation outruns the pace of institutional and policy innovation*. Whether they are reactive or visionary (or currently inattentive), understanding the current stated intentions of policymakers related to technology use in education can be critical in helping to plot the best way forward.

As an aid to a variety of policy discussions which are currently occurring around the world related to planning for the wide scale use of ICTs in education, and in anticipation of many more, here are some common messages that we have extracted from an analysis of national ICT/education policies over time in over 100 countries, organized according to eight key themes:

**Theme #1: Vision and planning**

- *Having a vision*
  It may seem obvious, if not axiomatic, that articulating and disseminating a vision to help guide efforts to introduce and utilize ICTs to support teaching and learning is important. That said, in 2015, not every country has done so -- and many countries have only articulated visions limited in scope to
certain specific topics (giving every student a laptop or tablet, for example, or connecting all schools to the Internet). Reasonable people may perhaps disagree about whether having a 'bad vision' is better than having 'no vision'. While in the short term the results can be disastrous (or at least very expensive), it appears on the main that even identifying the 'wrong' way forward can be better from a long term perspective than not aiming to go anywhere at all.

- **Linking ICT/education policies to other policies (including those 'outside the sector')**
  As education policymakers gain more experience, stronger and more explicit linkages between ICT/education policies promulgated by different governmental agencies and ministries, as well as broader policies related to education, technology use and economic development, typically come into place.

- **Providing a mechanism for funding**
  When ICTs are typically introduced within education systems, regular, reliable mechanisms to fund and support technology use over time are not considered. As costs are better understood, and as access to ICTs gains in strategic importance over time, financing related to ICTs beyond support for infrastructure becomes a more regular part of the budgeting process.

- **Authorizing authority to lead or oversee implementation**
  Over time, specialized agencies and organizations, with specialized competencies and responsibilities related to ICT use in education related to ICT use to support teaching and learning typically emerge.

- **Engaging the private sector**
  For a variety of reasons -- including those related to funding, access to industry expertise and stakeholder coordination -- public-private partnerships of various sorts often gradually assume greater prominence and importance.

**Theme #2: Infrastructure**

- **Ensuring adequate power**
  In many developing countries, issues around reliable and affordable access to power loom increasingly large in the minds of policymakers, and ICT/education policies may become more closely aligned with policies around e.g. rural electrification.

- **Providing sufficient equipment and networking infrastructure**
  When it comes to educational technologies, what’s 'sufficient' is typically a moving target. As ICT use increases, there is typically more demand for access to ICT devices and faster and more reliable connectivity. It is often only over time that the importance of technical support and maintenance becomes truly apparent, and that related funding and human resource measures are put into place.
Theme #3: Teachers

- Providing ICT-related training (technical and pedagogical) for teachers
  Support for teachers often is often deemphasized in the early stages of ICT rollouts in education; over time, most education systems slowly invest more in related technical and pedagogical professional development for teachers.

- Identifying a set of related teacher competency standards
  Competency standards for teachers are often revised over time to reflect the new demands placed on teachers as a result of the increased use of ICTs; new related formal certification schemes may be introduced as well.

- Supporting teachers in their use of ICT
  As follow-on to formal training programs, online and offline support mechanisms for teachers, including the networking of teachers themselves through the use of ICTs, typically increases in importance and emphasis over time.

- Building awareness among and support for school administrators, as a support for ICT use by teachers and learners
  Awareness raising and training for school headmasters of lags that for teachers, but over time, the potentially critical role of school administrators in enabling and supporting changed practices in schools as a result of ICT use assumes greater importance.

Theme #4: Skills and competencies

- Identifying ICT literacy / digital competency standards, and offering related training, support, assessment and certification
  One common rationale for investment in ICTs in education systems is to promote the development of 'ICT literacy'. In the early stages, this usually means an aptitude with basic software applications; later, it is about developing higher order skills associated with more complex 'digital literacies' (especially related to how ICTs can be used to support student learning).

- Articulating and supporting ICT-enabled lifelong learning opportunities
  As ICT use becomes more widespread across an education system, and as more people develop basic related skills and competencies, interest in the utilization of ICTs for learning activities outside of and beyond formal schooling typically increases.

Theme #5: Learning resources

- Supporting the development, dissemination and utilization of digital learning resources
  In the early stages of ICT deployments in schools, investment in devices is often prioritized over investments in the content that will be made available
through the use of such devices. Over time, this changes, and issues related to the mapping of digital content to specific curricular objectives, intellectual property, and the creation of digital teaching and learning materials by students and teachers themselves, gain greater prominence.

Theme #6: EMIS

- **Supporting the collection, processing, analysis, and dissemination of education-related data to relevant stakeholders**
  Policies around education management information systems are sometimes included as part of broader ICT/education policies. Where they are, initial policies are often rather minimal, and focus on the collection of basic enrolment data by a central body. Over time, as ICT use becomes more prevalent across an education system, more systematic and holistic views of data collection, processing, analysis and dissemination emerge.

  [Note: There is a separate SABER 'domain' that considers issues and topics related to education management systems in detail: SABER-EMIS.]

Theme #7: Monitoring and evaluation, assessment, research and innovation

- **Monitoring ICT use in education and evaluating its impact on teaching and learning**
  As countries invest more in ICTs, and as these investments become more strategic, a greater emphasis on monitoring and evaluation typically occurs, evolving from a simple counting of basic inputs (e.g. how many computers are in schools) to more sophisticated attempts to assess impact on learning.

- **Utilizing ICTs to support assessment activities**
  As ICT use become more widespread, interest in ICT-enabled assessments (e.g. taking tests on computers) becomes more common.

- **Dedicated support for exploring innovative uses of ICTs in education**
  Initial efforts to introduce ICTs and ICT-related initiatives in schools often begin as small pilots. Over time, such 'piloting' can wane as policymakers focus more on scale, but after large scale rollouts are completed, more dedicated interest in exploring new 'innovations' re-emerge.

Theme #8: Equity, inclusion and safety

- **Prioritizing “pro-equity” provisions and approaches related to the use of ICTs in education**
  While rhetoric related to closing 'digital divides' may characterize initial ICT/education policies, little attention is typically given to specific 'pro-equity' approaches targeting specific marginalized groups. As the nature of varied impacts on different groups are recognized, and as the easiest to
connect groups are connected, policymakers place greater emphasis on equity-related issues.

- **Articulating and supporting efforts to promote ethical practices related to ICT use in education, including the safety and security of data and appropriate privacy provisions**

Child digital safety issues and the promotion of practices meant to create greater awareness around 'digital ethics' typically only emerge in the later stages of policymaking related to ICT/education efforts.

**[Side note: With very few exceptions around the world, student privacy issues are for the most part *not* considered or addressed in ICT/education policies.]**

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These are twenty messages that have emerged out of a recent analysis of ICT/education policies around the world. (A related paper will be published later in 2015.)

Whether or not this rhetorical interest or attention by policymakers to certain key identified common themes translates into actual practices in schools, or by teachers and learners, is of course another matter. And: Even if/where it does, what appears to matter most to policymakers -- at least based on what is identified in related policy documents -- may not in fact be what's most important. It may well be the case that policymakers are missing some things -- some rather important things! -- or that their attention is directed towards areas that, in the end, are not terribly consequential in their impact on student learning, or on the health and performance of an education system overall.

Pointing out potential gaps between rhetoric and reality (or utility) can help inform the development of future policies related to technology use in education that are more relevant and impactful. Providing a means by which policymakers can benchmark their policies against those of their counterparts in other countries can hopefully help as well.

*You may also be interested in the following posts from the EduTech blog:*
- Analyzing ICT and education policies in developing countries
- Developing a national educational technology policy
- How to identify and locate national ICT and education policies
- Comparing ICT use in education across countries
- Collecting data about educational technology use in *all* countries in the world
- Worst practice in ICT use in education
- Ten things about computer use in schools that you don't want to hear (but I'll say them anyway)
Note: The image used at the top of this post of a man reading intently ("interesting ... this policy says this, and that policy says that ...") is (c) the Wellcome Library (library reference no. ICV No 25303). It has been slightly adapted (cropped) and is used according to the terms of its Creative Commons Attribution 4.0 International licence.
Research questions about technology use in education in developing countries
by Michael Trucano
#10: originally published on Wednesday, 27 May 2015

Back in 2005, I helped put together a 'quick guide to ICT and education challenges and research questions' in developing countries. This list was meant to inform a research program at the time sponsored by the World Bank's infoDev program, but I figured I'd make it public, because the barriers to publishing were so low (copy -> paste -> save -> upload) and in case doing so might be useful to anyone else.

While I don't know to what extent others may have actually found this list helpful, I have seen this document referenced over the years in various funding proposals, and by other funding agencies. Over the past week I've (rather surprisingly) heard two separate organizations reference this rather old document in the course of considering some of their research priorities going forward related to investigating possible uses of information and communication technologies (ICTs) to help meet educational goals in low income and middle countries around the world, and so I wondered how these 50 research questions had held up over the years.

Are they still relevant?

And:

What did we miss, ignore or not understand?

The list of research questions to be investigated going forward was a sort of companion document to Knowledge maps: What we know (and what we don't) about ICT use in education in developing countries. It was in many ways a creature of its time and context. The formulation of the research questions identified was in part influenced by some stated interests of the European Commission (which was co-funding some of the work) and I knew that some research questions would resonate with other potential funders at the time (including the World Bank itself)
who were interested in related areas (see, for example, the first and last research questions). The list of research questions was thus somewhat idiosyncratic, did not presume to be comprehensive in its treatment of the topic, and was not intended nor meant to imply that certain areas of research interest were 'more important' than others not included on the list.

That said, in general the list seems to have held up quite well, and many of the research questions from 2005 continue to resonate in 2015. In some ways, this resonance is unfortunate, as it suggests that we still don't know answers to a lot of very basic questions. Indeed, in some cases we may know as little in 2015 as we knew in 2015, despite the explosion of activity and investment (and rhetoric) in exploring the relevance of technology use in education to help meet a wide variety of challenges faced by education systems, communities, teachers and learners around the world. This is not to imply that we haven't learned anything, of course (an upcoming EduTech blog post will look at two very useful surveys of research findings that have been published in the past year), but that we still have a long way to go.

Some comments and observations, with the benefit of hindsight and when looking forward

The full list of research questions from 2005 is copied at the bottom of this blog post (here's the original list as published, with explanation and commentary on individual items).

Reviewing this list, a few things jump out at me:

1. Challenges in extrapolating research findings from one (highly developed) place to another (less developed) place
The operating hypothesis when formulating this list was that answers to some of these questions might be different in environments and contexts often found in less developed countries ('LDCs') than they would be in highly industrialized countries where related issues had been largely 'solved' -- or at least where there was expert consensus on the best way forward (even if that consensus was not having demonstrable impact on actual practice). Related to this, it was assumed that certain questions might be more important or relevant to ask when considering circumstances in less developed countries (research questions around 'interactive radio' might still be quite useful to explore in Sub-Saharan Africa, for example, even if the use of educational radio had largely died out across Europe). Given what has been learned over the past decade, I think that this hypothesis holds up rather well -- in fact, failed efforts to simply export 'solutions' from education systems in 'highly developed' countries to developing countries in Africa, Asia and Latin America underscore for me the need for applied research on educational technology approaches and applications tailored to meet the needs and contexts of decisionmakers in less developed countries. What works well in Oslo may not work well in Ouagadougou -- and vice versa.
2. The link between research & policymaking
Another rather important assumption (perhaps 'conceit' is the more appropriate word) that animated this list of research questions was that research can play an important role in informing policy decisions related to technology use in education. As someone who spends a lot of time helping to translate research findings into language that policymakers can understand and act on, and to communicate knowledge needs of policymakers to the research community, I of course would like to believe that this assumption holds. Unfortunately, though, based on observations of hundreds of educational technology projects over the past decade, it is pretty clear to me that, in too many cases, investments in educational technologies remain a largely faith-based initiative in many places around the world.

3. Equity issues
The number of research questions highlighting issues related to marginalized communities and the potential for differential impacts upon groups within those communities (related to e.g. gender, ethnicity, socioeconomic status, language and geography) is notable. Unfortunately, these still remain areas with insufficient research attention, especially as may relate to findings that may impact policymakers and/or which may inform the daily work of practitioners and local stakeholder groups.

4. A growing amount of research, but ...
There has been notable growth in academic research investigating uses of education technologies in developing countries over the past decade, both on the part of academics in 'developed' countries, and those in developing countries themselves. This is no doubt a good thing (especially the growth in local research and practitioner communities). Events like eLearning Africa provide valuable fora for research and practitioner groups to network with each other close(r) to home (as opposed to having to meet in London or Washington or Berlin in order to share findings with a critical mass of like-minded groups and people). That said, the most remarkable change in this regard for me has been the amount of corporate-sponsored research which has grown up over the past ten years to investigate issues related to technology use in education in developing countries. This is largely a consequence, I think, of the increased recognition by companies that many markets which were once considered 'frontier' are growing rapidly, and that many of them increasingly represent places where there is money to be made in the near term. The heady growth and diffusion of mobile telephony in most of the developing world is the most obvious marker of the fact that, for many companies, countries in Africa and Asia are no longer 'emerging', but rather increasingly occupy places front and center in corporate investment strategies. One of the occasional benefits of my job is that, even though I refuse to sign NDAs, I from time to time get peeks into internal corporately-funded research that is never published. Some of it is really quite good, it is a shame that so much of it stays locked away within companies even after the point where it no longer would convey a competitive advantage to the firm that sponsored it. What's released publicly as 'white papers' often reads to me more like it was written by the marketing department than something that can inform decisionmaking by other groups in useful ways.
5. What is (was) trendy (and what's missing)

Specific mention of a number of things (e.g. 'community telecentres') appears rather quaint from the vantage point of 2015, but there aren't too many buzzwords in evidence in the list from 2005 that are no longer relevant a decade later. I am asked often to provide input on 'emerging research topics in educational technology around the world', and I note that a lot of things that feature prominently in such efforts are wholly absent from the 2005 list. For example, the earlier list of research questions contains:

- no mentions of mobile learning (although handheld devices are mentioned, research question #29)
- no mention of MOOCs
- no mention of open education resources, or OER (although open source software is mentioned in research question #32; while there is no specific mention of intellectual property issues, these were actually meant to be considered as part of investigations into questions related to digital content, see research questions #39-41)
- no mention of data privacy or security (this is a *huge* omission from the perspective of 2015, in my opinion, even if as a practical matter it remains largely off the radar screen of educational policymakers in most countries)
- no mention of child digital safety issues
- no mention of game-based learning (or gamification)
- no mention of the potential use and impact of social media in education
- no mention of '21st century skills' (there is mention of 'computer literacy' in research question #2)
- no mention of how ICTs might be relevant to discussions of things like 'grit' or 'mindset' (which are of increasing research and policy interest in 2015), nor of 'big data' or sensors, 'learning analytics' or 'personalized learning', nor of many other topics considered hot topics for exploration today (Audrey Watters has a useful list of other current educational technology 'buzzwords'; one item that doesn't make her list, but which I have seen crop up in a number of research proposals lately, relates to the potential use of drones in education)
- no mention of power or electricity (these were of course certainly well known at the time, but they were not identified for specific attention in the 2005 list; despite improvements in electrification over the past decade, increased demand as a result of the increase in availability and use of electronic gadgets has in many ways made this even more important today than it was back then)
- no specific attention to specific Internet connectivity options (one suspects that 'satellite provision' would have been mentioned as part of such a question)
- and finally,
- no consideration of technology use within a wider systems approach to education (as features prominently in the World Bank's education strategy, for example, and its work under its flagship SABER analytical initiative)
So:

*Is this list of research questions related to ICT use in education in developing countries comprehensive?*

No, certainly not. For better or worse, there is a lot missing, especially when one considers certain categories of edtech-related research that are popular in certain circles.

*Does it reflect the 'top' or most pressing, most urgent research questions?*

No: It did aspire to do so in 2005, and it still does not do so from the perspective of 2015.

That said, there appears much in this list of research questions that is relevant today -- and indeed remains under-explored.

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By far the most common research-type question I am asked today is some variation of: *What is the impact of (this type of) technology on education?* This is a fair question, to be sure. I often find that my reflexive reply to this seemingly simple question ("it depends: what are you trying to accomplish?") is often not viewed as tremendously satisfying by many people. While I increasingly come across academic papers which attempt to identify the 'impact' of the use of a particular educational technology or technology-enabled approach, I remain quite frustrated that there is comparatively little interest in a related but, from the perspective of the people who make huge and often very costly decisions about such stuff, far more important and practical questions related to understanding how or why this 'impact' occurred: under what specific contexts or circumstances did it take place; what was the related enabling environment or key factors that led to failure; what were the costs of achieving this impact; etc. (A recent interesting paper examining *The Effect of Access to Information and Communication Technology on Household Labor Income: Evidence from One Laptop Per Child in Uruguay* is one of dozens of examples of research that identifies and investigates 'impact', but offers little guidance for policymakers on specific circumstances, contexts or explanations of why and how such impact may have been achieved.)

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Last week global leaders in education, ministers, policy-makers and representatives of civil society, teachers, experts and the private sector met in Korea at the *World Education Forum* to take stock of successes and failures over the past quarter century related to the achievement of initiatives aimed to help bring about *Education For All* and to jointly chart a way forward over the next decades. The resulting *Incheon Declaration* identified a series of principles and steps "towards inclusive and equitable quality education and lifelong learning for all".

Whatever the future holds for educators, learners and education systems in the years ahead, there can be little doubt that considerations of, and decisions about, education models and practices will increasingly include contemplations of the use
of a variety of information and communication technologies, in a variety of ways, to help meet a variety of goals and objectives. Even if their use is not (yet) relevant or cost effective in certain contexts and circumstances, 'ICTs' will increasingly be part of discussions about the 'future of education'. Whether or not related decisions will be evidence- or faith-based will rest in part on the existence of a rigorous and context-relevant research base which can help inform the development of educational policies; related implementation plans; and administrative, teaching and learning practices 'on-the-ground'.

Note: The image used at the top of this blog post of the acclaimed Dutch phycologist Anna Weber-van Bosse ("let's investigate this systematically") comes from the Special Collections of the University of Amsterdam via Wikimedia Commons. It is (c) University of Amsterdam, Artis Library and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license.

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50 research questions:
ICT use in education in less developed countries (LDCs)
Research topics and areas of activity meriting further investigation (2005)
[source]

Impact of ICTs on learning and achievement
1: How does exposure to and use of ICTs in school affect future employment?
2: What is the impact of 'computer-literacy' instruction in schools?
3: What is the gender impact of ICTs in education on access, use of, attitudes toward, and learning outcomes?
4: How can ICTs be used to present, comment on and discuss student work, and what are the implications and impact of such activities?
5: Are some school subjects better suited for ICT integration than others?

Monitoring and evaluation issues
6: What would be a useful set of 'core' indicators that could be used across countries?
7: How has monitoring and evaluation work related to the uses of ICTs in education been conducted in LDCs, and what can we learn from this?
8: How should monitoring and evaluation studies of the impact of ICTs in education in LDCs be conducted?

Equity issues: Gender, special needs and marginalized groups
9: What is the gender impact of ICTs in education on access, use of, attitudes toward, and learning outcomes?
10: How can/should educational content for dissemination via ICTs be produced to ensure inclusion?
11: How do the types of learning strategies fostered by the use of ICTs impact special needs and disadvantaged students, and how do they differ by gender?
12: How do different ICT applications, audio/verbal versus visual representations of educational content, and communicative modes impact communicative practices and create/reinforce/ameliorate various exclusions and inclusions as curriculum and communication methods are moved on-line?
13: What are the best practices for producing, disseminating and using educational content in audio format (including via radio) for deaf students?
14: How can issues related to ICT use for special needs and disadvantaged students by introduced into teacher professional development activities, and what are best practice examples of such activities?
15: What are the emotional, psychological and cultural impacts of ICT use on learners from disadvantaged, marginalized and/or minority communities?
16: What is the impact of the promotion of collaborative activities in groups facilitated by ICTs on students with little interest or background in computers, and what practices can better promote their inclusion?
17: Are there differential impacts of ICT use in education on identifiable sub-groups of boys and girls?
18: How can ICTs be utilized to attract and retain out-of-school and at-risk students (for example, through improved communication and provision of alternative modes of learning)?
19: How can ICTs be used to reach out to and teach illiterate youth?

Costs
20: What is the Total Cost of Ownership (TCO) for computers in a variety of educational settings, at both the school and system level? How should we calculate such figures?
21: What are the costs/benefits of situating ICTs for use in schools outside of computer classroom?
22: How can public-private partnerships be used to ‘cut costs’ and what are the resulting cost savings (if any)?

Current implementations of ICTs in education
23: How should ICT components in education projects supported by donors be identified and quantified?
24: How does access to and use of ICTs outside school impact the use and impact of ICT use in school?

Specific ICT tools used in education
25: What models exist for the effective utilization of ICTs to support on-going professional development for educators?
26: What are the best practices for mainstreaming pilot projects involving interactive radio instruction (IRI) at the Ministry of Education, and how are such projects managed and maintained over time?
27: Where should computers reside if they are to have the greatest learning impact in education?
28: Is the use of ICTs as in-class presentation mechanisms as cost-effective use of technology?
29: How have/can handheld devices (including SMS-enabled and 3G mobile phones) be used to support education (especially related to the professional development of teachers and school administration), and what are the emerging best practices?
30: What successful models exist for opening ICT facilities in schools to the wider community?
31: How can existing community and interactive radio networks outside the education sector be used to benefit education?
32: Does the use of so-called “open source software” offer compelling benefits in education?
33: What models exist related to effective public-private-community partnerships in education for ICT equipment provision and maintenance?

**Teachers, Teaching and ICTs**
34: Can the same types of pedagogical practices and transformations thought to be enabled by the introduction of ICTs be introduced and maintained in environments where ICTs are not used?
35: How can we measure outcomes of ICT use by teachers resulting from participation in professional development activities?
36: Which models of ICT use can provide the most effective and relevant support for professional development, including enabling peer networks, and how?
37: How are ICTs currently being used at the pre-service level (if at all) to train teachers in LDCs, and what can we learn from such use?
38: What are the most successful and relevant strategies for using ICTs to change pedagogical practices?

**Content & Curriculum**
39: What are the best practices for creating electronic/digital curricular content?
40: What is the relationship between uses of ICTs, curricular issues and standardized testing?
41: What special issues relate to the creation, dissemination and use of curricular content in indigenous languages?

**Policy issues**
42: How can/should EFA-related issues as they relate to the uses of ICTs be included in the decision-making processes of education officials?
43: What ICT in education policies are currently in place, and how do they address EFA-related issues?
44: How can ICTs be used to facilitate the decentralization process underway or contemplated in many Ministries of Education?
45: How can ICTs be used to combat corruption in the education sector?
46: What are the best practices from implementing education management information systems (EMIS)?
47: What regulatory issues exist related to connectivity and information access issues as they relate to the education sector, and what guidelines and best practices have emerged?

**School-level issues**
48: What are successful examples of how ICTs have been introduced and maintained in schools?
49: What types of information must be provided to schools to aid in the introduction and maintenance of ICT-related equipment and to promote ICT-related instruction?

**HIV-AIDS**
50: What models exist for how existing ICT-enabled information distribution mechanisms in education can be utilized to carry information about HIV-AIDS, and what related best practices have evolved?
Lessons from the drafting of national educational technology policies
by Michael Trucano
#11: originally published on Friday, 12 June 2015

Begun in 2004 by the ICT/education team at UNESCO-Bangkok, who were later joined by AED, Knowledge Enterprise and the infoDev program of the World Bank (where I worked), the *ICT in Education Toolkit for Policy Makers, Planners and Practitioners* was utilized as part of policy planning and review processes in over thirty middle and low counties in the course of the following decade.

In support of face-to-face and online interactions that typically lasted for many months (and in a few cases, years), mainly in countries in East Asia and the Pacific, the Toolkit provided interactive instruments and step-by-step guidelines to assist education policy makers, planners and practitioners in the process of 'harnessing the potential of ICTs to meet educational goals and targets efficiently and effectively'.

The toolkit was designed with the needs of two specific groups in mind: (1) Key decisionmakers in countries and educational institutions as they struggled with the challenge of introducing and integrating ICTs into education; and (2) program officers and specialists in international development agencies as they identified, prepared and appraised ICT-in-education projects or ICT components of education projects.

The *ICT in Education Toolkit* itself is no longer in use -- with the great changes in technology over the past ten years, maintaining an online toolkit of this sort proved to be too difficult. That said, a number of key lessons emerged from this effort which might be quite relevant to policymakers going forward who are seeking to provide policy guidance, direction and oversight on issues related to the use of new technologies in education systems.

Here are some of them:
1. Who participates is often as important as what is decided
When a process kicks off to formulate a new policy related to ICT use in education, it (almost) always results in the development of such a policy. In a general sense, such a process can thus be labelled a 'success'. Whether such a policy is actually a 'success' in practice, however -- by positively impacting the lives and teachers and students in useful ways, for example -- can be as much a function of which groups and stakeholders participated in the policy formulation process as what the policy itself eventually contains. In other words: Who is in the room can be critically important! Policymaking around technology use in education is often challenging in new ways because it can (or should) involve or encompass multiple actors and stakeholder groups, from within and across government, as well as private firms and civil society groups. In some countries, ICT/education policy formulation is led by the ministry of education, in other countries the ICT or telecom ministry takes the lead, in still others a special office under e.g. the president or prime minister may play the lead role. (In some dysfunctional policy environments, all three groups may independently develop their own policies in this regard!) Finding a way to coordinate the policymaking activities and functions of such groups, as well as the various implementation roles of key stakeholders, can be very difficult, but the lines of communication that are opened as a result of trying to do so can be very important when it comes time for implementation. Even where a resulting policy may be 'bad' or inadequate/incomplete, making broad stakeholder engagement a key part of the related policymaking process can represent a key practical success going forward.

2. Upcoming procurement activities often catalyze ICT/education policy formulation (and re-formulation)
A key factor catalyzing many efforts to create new policies related to technology use in education in schools is the fact that a large-scale procurement of ICT equipment looms on the horizon. In many cases, existing policies provide little guidance related to what is being promised by political leaders (e.g. large numbers of schools are to be connected to the Internet, or will receive computer labs, or students are to receive laptop computers). In other words, 'the technology tail is wagging the policy dog'. One consequence is this phenomenon is that the initial focus of policy development is to help guide the roll-out of new technologies to schools, and not in how such technologies can be used in support of existing policy goals and objectives.

3. A single group is often core to the implementation of ICT/education policies
Whether policymaking authority is diffuse or highly centralized, a single group is often core to the implementation of national educational technology policies in middle and low income countries. In some cases this is a specific department or unit of a government ministry, in others it may be a quasi-autonomous national ICT/education agency under the direction of one or more government ministries. Including representatives from this from this implementing group as explicit part of the process of related policy formulation can help surface valuable practical perspectives and lessons from experience which can help ground the development of new policies in an understanding of what is possible and 'do-able'.

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4. The private sector can play a key role
In many national educational technology policies, a key role is identified for a number of private groups (both companies and NGOs) in the implementation of such policies, sometimes couched in the terms of a 'public-private partnership'. As a practical matter, such groups often provide informal related advice and guidance to policymakers, based on their practical experiences and know-how -- and, it is important to note, their own self-interests as well. Figuring out ways to incorporate such voices within the policymaking process can be important, both as a bridge to eventual implementation efforts, to ground such processes in on-the-ground-realities and know-how, and to promote greater transparency around such activities. Government authorities may not have existing relationships with many such 'nontraditional' actors, but involving them in the policymaking process can provide a way to help build such bridges.

5. Technological changes typically outpace the abilities of policymakers to keep up
While ICT/education policymaking is (hopefully!) quite forward-looking in nature, at least rhetorically, it is also the case that it can be as much about helping to formalize practices which are already on-going within an educational system which had previously happened with little or no government guidance or oversight. When it comes to policymaking around ICT/education issues, there is often a tension between how much government should lead, and how much it should follow things which are already happening within individual schools and communities, as well as local markets. When it comes to making accurate prognostications about the future of technology use, education officials do not generally have a track record of great success, and there is always a danger that ill-conceived or overly ambitious policies can stifle, rather than support, the emergence of technology-enabled innovations within various parts of an education system. At the same time, while a lack of related policy guidance can open up spaces for innovation, it can also lead to great inefficiencies, and allow for new (digital) divides to develop, and for longstanding divides within an education system or society to widen.

6. Equity issues and concerns can present fundamental challenges within policymaking processes related to ICT use in education
Desires for action and to demonstrate 'quick wins' as a result of a new national educational technology policy can greatly complicate goals related to equity and fairness. Do you first connect the schools which are easiest to connect, or train the teachers who are already the 'best'? The temptation to do this can be large. Such school and teachers are often found in communities where students already possess a number of advantages (related to wealth, for example, or the fact that they live in urban areas). While rhetoric around helping to close the 'digital divide' can mark key opening passes of ICT/education policies, and such sentiments can be an important catalyst for the development of an ICT/education policy, great care needs to be taken to insure that individual components of such a policy align with, and don't stand in practical opposition to, a more general policy interest in promoting equity.
7. The technologies and devices introduced into education systems as a result of ICT/education policies can help monitor the implementation of these same policies

When introduced into schools and education systems, information and communication technologies (ICTs) are by their very nature dual- (or multi-)use. Connecting schools to the Internet and providing students with access to laptops is often largely seen by policymakers to represent new possibilities to disseminate new or additional learning materials to teachers and students. While this is undoubtedly the case, the existence of such connected tools in the hands of teachers, students and school administrators also offers new ways for government to monitor the extent to which its policies are actually impacting activities at the school and classroom level. In other words, an ICT/education policy which broadens access to connected digital tools and devices can help establish a very important feedback loop to help policymakers better understand what (if anything) might be changing in the lives of schools and learners as a result of such policies. For many policymakers, this represents something fundamentally new.

These are some of the key general lessons that I have taken away from involvement in helping to coordinate and advise on national educational technology policymaking efforts over many years. Other key participants in these processes may of course have learned other things, or even disagree with some of what I have put forward here: Fair enough! But hopefully some of what I have shared here will resonate with people starting new initiatives to formulate, and re-formulate, educational technology policies within their countries, and will be useful to them as they move forward with such efforts. To such folks, I say: Good luck!

You may also be interested in the following posts from the EduTech blog:
- Key themes in national educational technology policies
- Analyzing ICT and education policies in developing countries
- Developing a national educational technology policy
- How to identify and locate national ICT and education policies
- Worst practice in ICT use in education
- Ten things about computer use in schools that you don't want to hear (but I'll say them anyway)

Note: The image used at the top of this blog post of a man playing a rather interesting trombone ("let me make sure to press the right levers in the right order so that I'm in harmony with everyone else") comes via Wikimedia Commons. It was originally posted to Flickr by J.C. Rojas and is used according to the terms of its Creative Commons Attribution-Share Alike 2.0 Generic license.
When planning for new initiatives that will introduce and/or utilize information and communications technologies (ICTs) in some way, a simple general rule of thumb is worth considering:

The best technology is often the one you already have, know how to (and do) use, and can afford. In many places around the world, this technology is the mobile phone.

This is not to contend that 'new' technology devices should not be considered -- far from it! Rather, this general guidance is meant to serve as a reminder for planners and decisionmakers to consider how it might be possible to take advantage of and leverage *existing* technologies, and the activities and processes these technologies enable, before committing to introduce totally new (or foreign) technology tools into a given environment. Just because something is new doesn't mean that it is automatically better. Of course: It doesn't mean that it is worse, either.

At a conceptual level, when considering what technology devices are to be utilized as part of a given project or activity, mobile phones may often be the 'best' technology. But: Does that make the mobile phone an appropriate or practical technology choice for use in schools, and/or by students and teachers?

It depends.

When it comes to mobile phones and the education sector, things aren't so simple, and answers vary considerably by place -- and are changing. In some countries and schools, mobile phones are not allowed at all for students (and in some cases for teachers as well) and/or their use is limited to certain circumstances inside (and in some instances even outside) of school. In other places, phones are allowed with few restrictions. In yet other places, long time bans on phones are being reversed. Even where bans are in place, phones are still to be found in schools, for better and
for worse, and they are used for a variety of purposes (again, for better and for worse).

**What are some current perspectives and practices related to the use of mobile phones in schools and education systems around the world?**

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**Imposing -- and removing -- bans on phones in schools**

New York City lifted a ban on mobile phones in its schools earlier this year. In May, two academics published a widely read paper (*Ill Communication: Technology, Distraction & Student Performance*) which argues that "student performance in high stakes exams significantly increases post [mobile phone] ban". A few weeks later, Barbados lifted a longstanding ban on mobile phones in schools.

*What's going on here? Who's right?*

Bans on mobile phones in schools began in earnest in many parts of the world around 2008-2012 ... about 5-10 years *after* the first wave of efforts to 'unban' (or allow) phones in schools in many U.S. states gathered momentum.

Discussions about whether or not to ban phones in schools in Jamaica in 2007 echoed conversations in many U.S. states in 2002 which led to bans being relaxed, or where the responsibility for such bans were transferred to more local jurisdictions. In the U.S. state of California, for example, a blanket ban on phones in schools in place since 1988 was lifted in 2002. Instead, local school boards were able to adopt their own local policies in this regard (and in some cases further delegated related authority to individual schools, and in some cases to teachers to make decisions about what was appropriate in their own classrooms).

In contrast, a bill to ban phones in schools was introduced in France in 2009. Bans came into effect in places like Nigeria in 2012, around the time that teachers in the Solomon Islands called for phones to be banned in their schools. Uganda banned phones in schools in 2013, one year after Malaysia reaffirmed its own similar ban.

And it's not only been in schools where young people have been prohibited from using their phones over the years. In one prefecture in Japan in 2014 children were not allowed to use phones after 9pm, not long after Belgium banned the sales and advertising of phones to children under seven. Earlier this year, bans on student use of phones inside and outside of schools were considered in Indonesia.

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Many reasons are commonly cited in support of banning phones from schools. They *include*:
Why to ban phones in schools

1. **They are distractions**
Anyone who has ever been in a conversation with someone who spend most of the time looking down at her phone, or whose speaking was interrupt by the chirping or buzzing of someone's phone (in other words: everyone) will understand this reason. (When you hear some educators and administrators referring to the new age of 3D that education technologies are enabling, this is often not a positive statement about the promise and potential of 'virtual reality', but rather lamenting the role of phones in classrooms as 'digital distraction devices'.) It is not only that phones distract learners -- in some places, phone use by teachers is seen as a distraction (as in Bangladesh).

2. **They present (possible) health issues**
Much has been made in certain quarters about the potential damage that radiation from phones present, especially to children. (Here's the latest guidance on this contentious issue from the World Health Organization). There are other health-related worries about potential impact on eyesight and about the role of phones (and other devices) in enabling 'cyber-addiction' (for what it's worth, such worries are often especially acute among many policymakers in East Asia).

3. **Cyber-bullying (and protection from violence)**
The role that phones can play in so-called cyber-bullying is well known. In addition to the psychologically damaging role that phones can play, there are also worries about the potential use of such devices in certain places in helping foment unrest (as in Kenya), and particularly their use to 'protect' women and girls (here are two examples from different parts of India). In some schools in the United States metal detectors are used to prevent students from bringing weapons to schools; in some Chinese schools they are used to prevent mobile phones from entering.

   *Anecdote: I once visited a school for girls in Papua New Guinea and asked whether or not phones were allowed. I was not surprised to learn that they were not (I often ask questions to which I think I know the answer, assuming that I might not be as smart as I sometimes think I am -- and because I like it when I am surprised by answers that contradict or challenge what I think I 'know'), but was a little shocked at the reason why -- girls had been using them to arrange fights between classes and after school.*

4. **Cheating**
Students around the world have long been innovative in the ways they have utilized technologies to cheat on exams. The mobile phone is a device can be particularly helpful in this regard. (Some education systems are becoming innovative themselves in utilizing new technologies to help detect such efforts.)

5. **Theft**
Carrying around expensive gadgets make students potential targets for thieves.
6. Impact on student performance
Where's the evidence that having phones in school (positively) impact student performance, ask many supporters of mobile phone bans? To date the evidence base in this regard is pretty thin, for or against, although one recent study from England argues that the impact of phones in schools is negative -- especially when it comes to low income students. (Research in this regard is still in its infancy, however -- and almost entirely based on contexts and circumstances in certain 'highly developed' economies which may or may not be relevant to schools and learners and communities in other parts of the world.)

Which highlights issues related to ...

7. Equity
If phones are allowed in schools, they are more likely to be owned by students from wealthier families -- and the phones that wealthy kids have may be more powerful than those of students from lower income families. Such concerns can be especially acute where schools have adopted 'bring your own device' (BYOD) policies.

There are many other reasons put forward in forth of banning phones in schools, and reasons for banning phones in schools might potentially apply in other contexts as well (as mobile learning pioneer Steve Vosloo argued tongue-in-cheek in an influential presentation, Let's Ban Malls), but I'll stop here.

(I will note, however, that in certain places companies that sell tablets and laptops quietly advocate that phones be banned in schools -- no doubt so that their own products face less competition. Indeed, various groups can benefit from bans on mobile phones in schools in ways that can be surprising. In 2012 it was estimated that local businesses in New York City -- from corner stores to trucks parked near school entrances -- made US$4m annually be renting spaces to students to store their phones during the school day.)

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With such a long list of reasons why it makes sense to ban phones in schools, why would it make sense to allow them? Here are a few reasons:

Why not to ban phones in schools

1. Phones are already in schools -- and there to stay
Mobile phone ownership and use is increasingly ubiquitous across many societies -- and will no doubt become even more firmly embedded in people's daily lives going forward. Given this reality, does it make sense for schools to be a phone-free zone? Maybe. But where bans are in place and are widely flouted, such disconnects can undermine authority in ways both minor and pernicious -- and enforcement can also serve to selectively punish certain groups of students that undermine social cohesion in ways that are simply not productive (or fair).
2. Why buy so many new computers for schools when lots of students already have small computers in their backpacks?
As many education systems seek to roll out educational technology initiatives in their schools, they are faced with very large costs related to procuring new hardware. In many places, once the hardware is purchased, this is little money left to spend on the software and content that will be accessible through such devices, and for training of teachers and students on how to take advantage of the new devices. Given fiscal constraints across pretty much all education systems around the world, is it prudent to simply ignore the fact that there is an installed ICT infrastructure that students already know how to use just because it was not originally purchased by government?

Anecdote: I was once in a school in a low income community in Brazil. Policymakers were considering purchasing lots of low cost tablets for use in such places. In one classroom I asked how many students had a personal mobile phone with them -- all but one did. You are preparing to spend *lots* of money on handheld computing devices for use by students such as these in classrooms such as this one, I commented to the education officials who were with me. Has the fact that almost all of these same students already have a computing device with them factored into your decisionmaking in any way?

3. Ethics, and responsible use
To the extent that school is about helping students develop the knowledge, skills and attitudes that will be useful to them in life, does it make sense not to help students figure out how to use a device that will, for better or for worse, increasingly impact many aspects of their lives, in ways large and small, in ways that are ethical, safe, efficient and productive?

4. Safety and convenience
Many parents argue that phones should be permitted in schools for reasons unrelated to learning. They just want their kids to be able to call them if something goes wrong, if predetermined plans change, if advice or information is quickly needed -- or vice versa.

5. Phones can be tools for learning
Today's phones are getting more and more powerful -- and less expensive. Smart phones today have more computing power than NASA had when it helped put a man on the moon. A new iPhone CPU has 625x more transistors than a 1995 Pentium processor, as a16z's Benedict Evans notes. That's all well and good, you might say, but smartphones are for rich people in rich countries. That is certainly true. It is also true, however, that smart phones now account for 50% of all new phone purchases in Kenya, and it is projected that smart phones will represent around 75% of the market for mobile phones across Africa by 2020. The potential relevance of the use of such phones for learning going forward is hard to deny (and a regular topic explored on the World Bank's EduTech blog).
Anecdote: A while back I was chatting with the Minster of Education from an African country. 'We thought we were being very foresighted when our parliament enacted a law to ban phones in schools a few years ago', he told me. 'Now, however, as minister I would like to explore how we can explore how we might use these as tools for learning in our schools. We cannot do this, though, because doing so is illegal. Any ideas on how we could get this ban overturned?'

There are legitimate reasons to ban phones in schools. There are legitimate reasons to allow them as well. Different education systems around the world assign different values to these reasons, and accordingly make different decisions as a result. What, then, is a policymaker to do?

There are no clear cut answers for many policymakers when it comes to (banning or unbanning) mobile phones in schools. Whatever decisions are taken, however, here are:

**Five common pieces of general advice for policymakers related to the mobile phones in schools**

1. **If you are not thinking about this stuff: You probably should be**
   Mobile phones are already in your schools -- and if they are not there yet, they will be there soon. They are becoming increasingly integral to the way that citizens in your country, including young people, live their lives -- for better and for worse. This is a reality, and it is worth considering what the implications of this reality are for learners, teachers and school administrators.

2. **There are multiple dimensions to consider**
   There are many dimensions to consider when it comes to mobile phone use in schools. It's not just about learning, or safety, or financial considerations, or equity, or practical issues. It is potentially about *all* of these things.
3. **Stay flexible**
There are many ways to provide direction related to the use of mobile phones. Ministries of education (or ministries of culture) can provide general guidance related to mobile phone use. They can enact outright bans -- or allow their use in certain contexts or circumstances, or by certain groups of people. They can lobby for (or against) legal restrictions that originate in or are unforced by other parts of government. They can transfer responsibility for such bans or directives to more local educational authorities, from regional or district education offices all the way down to school principals or even individual teachers themselves, so that related decisions can be made locally.

4. **If you are considering buying lots of hardware for schools, it may be worthwhile to take a step back (BYOD may be looming)**
Moves to enable 'bring your own device' (BYOD -- sometimes also referred to as 'bring your own technology', or BYOT) are increasing in many education systems around the world. While such policies, or the practices they enable, may not yet be practical or relevant yet in your country -- but they may soon be. If you are devising education policies and plans e.g. for the next decade, it might be worth learning from related experiences in other places, because those experiences might well be relevant to you within this time frame.

5. **Revisit your approach regularly (perhaps even annually)**
Whatever your policy is today related to mobile phones in schools, it is inevitable that new developments may challenge your current policies and practices. Given the rate of change with technology in society, you would do well to consider, and re-consider, how previous decisions related to technology use in your schools may no longer be valid -- or may be needed going forward in ways you had not previously anticipated.

Mobile phones in schools: To ban or not to ban? Whatever the slings and arrows of outrageous fortune may turn out to be, one thing is for certain: *This stuff will only get more complicated.*

(to be continued ...)

*You may also be interested in the following posts from the EduTech blog:*
- A 'mobile first' approach to educational technology
- In search of the ideal educational technology device for developing countries
- Questions to ask (and not to ask) when your president tells you to buy 100k (or a million) tablets for students
- What we are learning about reading on mobile phones and devices in developing countries
- Bad practices in mobile learning
- Promising uses of technology in education in poor, rural and isolated communities around the world

*Note:* The image of an old phone box near the village of Higham in the Forest Heath district of Suffolk, England (“forbidden ... or encouraged?”) comes from [Keith Evans](https://commons.wikimedia.org/wiki/File:Higham_phone_box.jpg) via [Wikimedia Commons](https://commons.wikimedia.org/). It was originally uploaded to the [Geograph](https://www.geograph.org.uk) web site and is used according to the terms of its [Creative Commons Attribution-Share Alike 2.0 Generic license](https://creativecommons.org/licenses/by-sa/2.0/). The image of
three phones on display at Kim Il-Sung Sqaure in Pyongyang, North Korea used later in the blog post ("your choice is about more than colors") comes from Roman Harak via Wikimedia Commons. It was originally posted to Flickr and is also used according to the terms of its Creative Commons Attribution-Share Alike 2.0 Generic license.
Tablets in education
by Michael Trucano
#13: originally published on Tuesday, 28 July 2015

While it can sometimes be difficult to understand just what exactly the related question or challenge is, in many education systems around the world, the 'answer' or 'solution' put forward is increasing the same:

'Tablets!'

Indeed, it seems that, over the past few years, not a week has gone by without some sort of high profile announcement about a new educational tablet initiative somewhere - or about changes to an existing such project.

Excitement about the promise and potential of information and communication technology (ICT) devices for use in teaching and learning has been around for a few decades, but only recently has this been translated into large scale purchases of such devices for use in schools outside of industrialized, 'highly developed' countries. What's happening where, you ask?

Here are some random, but fairly representative, reports from recent years about this undeniable trend:

- Brazilian government to give tablets to state school teachers
- Fatih Project distributes 732,000 tablets (Turkey)
- Indonesian students in remote areas will soon receive tablets to replace textbooks
- Tablet computers in Kazakhstan schools by 2020
- Distribution of tablets to teachers for e-Learning project begins (Jamaica)
- Tablet-based learning taking shape in Malawi
- Russia announces new e-reader tablet for use in schools
- Swedish schools aim to ditch books by 2013
- Finnish school abandons books for tablets
- Romanian Education Ministry wants to equip all schools with tablets
- As Liberian schools remain closed, tablets could become digital classroom
- Colombian students and teachers will receive 900,000 tablets for free
- One primary school pupil, one tablet: Dakar mayor (Senegal)
- 410k tablets distributed to schools in 4 regions of Peru

Not all the news is about tablets going *out* to schools; devices can flow in the reverse direction as well:
Junta’s Basic Education Commission wants One Million Tablets Returned from Children (Thailand)
• Government withdraws 88,000 tablets from schools due to theft (South Africa)
• L.A. Unified takes back iPads as $1-billion plan hits hurdles (USA)

It's true that not everything that is announced actually comes to pass. Timelines are often a moving target, and the scope and/or scale of a project as initially conceived can change radically. But the trend is clear.

**Why are educational policymakers authorizing the purchases of so many tablets in so many education systems around the world?**

Here are the five most common answers I get when asking this question:

1. As one education official put it to me earlier this spring (I am only slightly paraphrasing), tablets 'are what people use today for learning. They used to use desktop computers, and then laptops. Now they use tablets.'
2. Like other education technology devices, tablets are seen by some as powerful and iconic symbols of modernity within an education system. As such, their purchase and use within schools is seen to be representative of a forward-looking, modern educational system, and their existence and use can play a key role (both political and functional) in helping to introduce and advance a specific educational reform process within an education system.
3. A decision has been made to buy lots of new equipment, and tablets are thought to be easier for kids to use than laptops or desktop PCs (the other choices considered).
4. The shape and size (or what technology folks often call the 'form factor') of the device is like a book -- and books are what education systems are used to buying.
5. Tablets have been shown to promote more learning. (I'll note parenthetically that the 'evidence' used to support this contention is often rather weak; more on this below.)
6. Specific software applications or learning content to be used for teaching and learning are only available (or only thought to be available) on a tablet.

One reason that is *not often openly stated* by a ministry of education official, but which may in fact be an important part of the equation in certain countries, is that government wishes to jumpstart the fortunes of a local ICT industry, and figures that buying lots of tablets can help in this regard -- especially where there might be a local company that assembles tablets (while most of the parts may come from China, the final product may not: countries as diverse as e.g. Cote d'Ivoire and Haiti, Zambia and Morocco all have local tablet companies).

You may or may not consider these to be compelling reasons, but they are, for what it's worth, the most common ones I hear.

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That's all well and good, you might say, but, taking a slight step backward, you might be inclined to ask:
What makes a device a tablet?
There are lots of definitions of a 'tablet', and it can be easy to get lost in the weeds or debate specific characteristics. In my work with education systems around the world, four basic characteristics pretty much define the product category:

1. A student can hold it easily in two hands.
2. It's portable.
3. It's bigger than a 'phone'.
4. It's primarily operated using a touch (screen) interface.

When it comes to 'tablets', certain definitions can allow for grey area which can confuse things, especially when it comes to procurement. If you attach a keyboard to a tablet, does that make it something other than a tablet? How about if a laptop screen is detachable and features a touch screen interface? Difficulties with definitions has led some education systems to consider the use of functional vs. technical specs in their procurement documents.

OK, like Potter Stewart said in another context, even if I have trouble coming up with a very specific, useful definition, when it comes to a tablet, I know it when I see it.

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What makes something an 'educational' tablet?
Once it's been decided that a certain device qualifies as a tablet, there is then a further question about what constitutes an 'educational' tablet. 'Educational' tablets typically display one or more of the following characteristics:

1. They come preloaded with specific 'educational' software and content (and the user interface may sport a specific 'skin' or 'operating environment' designed for student users).
2. They come in funky colors (the device casings themselves, or a special rubbery sleeve that fits snuggly around the device, may be blue, or green or red, or some other color thought to be 'appropriate' for children).
3. The device may ruggedized in some way (to protect it from falls, rough handling, etc.).
   and, perhaps most fundamentally:
4. The device is specifically labelled and/or marketed as an 'educational tablet'.

With these definitions out of the way (in ways that may or may not be entirely satisfactory), we can then turn to two broader questions that might be of more fundamental interest or relevance for policymakers:

What do we know about large tablet initiatives in schools?
What do we know about the related evidence that they are (or are not) having an impact on student learning?

In order to help answer the first question, the Commonwealth of Learning (COL is an intragovernmental organization whose members are the ministries of education
of over 50 countries that belong to what was previously known as the British Commonwealth of Nations) published a short report earlier this year that looked at a number of national efforts around the world. Large-Scale, Government-Supported Educational Tablet Initiatives notes that: "A growing number of countries are embarking on large-scale, government-supported initiatives to distribute tablet devices to students in the K–12 schooling sector. Unfortunately, there is a misconception that by simply putting this technology in the hands of students, educational access issues will be resolved and educational transformation will occur. In this research project, a systematic review of current government-supported tablet initiatives around the world was conducted to understand their origins, underlying principles, financial and organisational models, and expected outcomes. An extensive literature search and data extracted from identified documents showed that 11 countries have launched government-led tablet initiatives. The review concluded that the majority of these initiatives have been driven by the tablet hype rather than by educational frameworks or research-based evidence."

This report was the result of a desk study sponsored by COL and drew largely on media mentions of government-supported educational tablet projects around the world. It paid particular attention to large-scale, government-supported tablet initiatives in eleven countries: Antigua & Barbuda, Australia, Brazil, India, Iran, Jamaica, Kazakhstan, Pakistan, Russia, Turkey, and the United Arab Emirates.

Considering this and other programs, COL found that "none of the identified initiatives was supported by a rationale or evidence for why tablets in general would help achieve the articulated objectives, let alone be supported by the reasons for selecting a particular brand or type of tablet."

Now, just because a ministry of education hasn't articulated exactly how exactly a particular initiative will help meet certain specific objectives doesn't mean that such objectives won't be met as a result of a given project. It certainly doesn't make such an achievement more likely, of course, but it doesn't rule it out either. With that in mind, and whether or not a ministry has decided to buy lots of 'educational tablets' for the 'right' or the 'wrong' reasons, what do we know about the impact of tablet use on student learning?

Like the use of educational technologies more generally, regardless of which specific technology device we are talking about, the evidence base when it comes to tablet use in schools and to support student learning is rather weak, and can be used in support of or against pretty much whatever scheme is being considered. Most of the related research to date comes from schools in 'highly developed' (OECD) countries, relies on projects with small sample sizes, are of short duration and/or rely heavily on self-reported and/or qualitative data. An upcoming paper to be published in the Journal of Computer Assisted Learning examines this existing
research base. *Tablet use in schools: A critical review of the evidence for learning outcomes* looks at 103 research studies and then, after applying certain selection criteria, examines 33 of them more closely before eventually building a cohort of 23 studies based on methodological trustworthiness and relevance. The paper also contains a useful short roundup of notable studies from developing countries. While most of these did not meet the selection criteria, these are no doubt useful pointers to initiatives that merit additional investigation.

What did the three researchers (Hassler, Major and Hennessy) find? "16 of the studies reported positive learning outcomes, 5 no difference and 2 negative learning outcomes". They note that the "fragmented nature of the current knowledge base, and the scarcity of rigorous studies, make it difficult to draw firm conclusions. The generalisability of evidence is limited and detailed explanations as to how, or why, using tablets within certain activities can improve learning remain elusive. We recommend that future research moves beyond exploration towards systematic and in-depth investigations building on the existing findings documented here."

Few of the research studies related to tablet use in education offer much useful relevant insight into which of the particular affordances of tablets (e.g. their size, their touch interfaces, the use cases that they lend themselves to) are important. Is it simply having an educational computing device that is important, or is there something specific about a tablet that makes it a particularly relevant option for consideration by educational policymakers and planners?

The sample sizes of the impact studies to date are in many cases quite small, and few of the studies feature randomized control trials (considered the 'gold standard' in some quarters).

Hassler, Major and Hennessy believe that there is "clearly potential [...] to enhance the methodological rigour of future research that investigates the use of tablets in schools". Hopefully recently announced research projects like J-PAL's Post-Primary Education Initiative, which has an RFP open until 15 September which notes that "preferential consideration will be given to proposals on the following topics", including the "use of information and communication technology (ICT) for student learning or teacher training at the secondary level" will help support a few rigorous evaluations that will enrich our collective understanding of this area of increasing activity.

Given the size, scope and ambition of the many educational tablet initiatives that continue to be announced around the world, there will be no shortage of candidate projects to study in the future. Hopefully researchers, and the organizations which fund them, will consider this an area of increasingly important and relevant inquiry going forward.

*You may also be interested in the following posts from the EduTech blog:*
- Big educational laptop and tablet projects -- Ten countries to learn from
- Ten observations about 1-to-1 educational computing efforts around the world
• Questions to ask (and not to ask) when your president tells you to buy 100k (or a million) tablets for students
• The Aakash, India's $35 (?) Tablet for Education
• Observing Turkey's ambitious FATIH initiative to provide all students with tablets and connect all classrooms

Note: The image used at the top of this blog post of a multi-colored collection of pills ("tablets: the cure for what ails education?") from RayNata via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 4.0 International license. The second image of Moses carrying two tablets ("pointing the way to the promised land?") comes from an oil painting by Justus van Gent and Pedro Berruguete via Wikimedia Commons and is in the public domain.
Much is made of the need for 'innovation' in education. Bullet points containing words like 'disruption' and 'transformation' increasingly characterize presentations at big education gatherings -- especially in North America, and especially where educational entrepreneurs and 'Silicon Valley-types' are to be found. The popular press is replete with (sometimes breathless) articles about the 'revolutionary' potential of some new technology to impact teaching and learning in ways that are often quite exciting. Indeed: There can be little doubt that the increased diffusion of low(er) cost, (more) powerful, connected IT devices across and within communities offers exciting possibilities and potential to do things differently -- potentially in a good way.

For many people, the use of technology in education constitutes a de facto 'innovation'. Whether or not this belief is actually accurate, or useful, is a legitimate question for discussion. That said, there is no denying that many of the educational innovations celebrated (or at least touted) today are enabled by the use of such technologies in some way.

Around the world, there few more conservative and traditional sectors than those related to public education. In many ways this is totally understandable, and appropriate. Investments in education represent investments in the future -- of our children, of our future citizens and workers and leaders and community members. We don't want to gamble with or experiment with the way we educate our children and try out too many new things, or so goes one line of thinking. The potential downside, or failure, carries with it consequences that are just too great.

And yet: We know that, for millions children around the world, the education they are getting today isn't actually all that great. Some frightening stats from just one page of the latest Global Monitoring Report [pdf], drawing on recent research from RTI:

- In Nicaragua in 2011, around 60% of second-graders could not identify numbers correctly and more than 90% were unable to answer a subtraction question.
- In Malawi, 94% of second-graders could not respond correctly to a single question about a story they read in Chichewa, the national language.
- In Iraq, 25% of third-graders were unable to tell the sound of a letter in Arabic.
And if you think that the situations in certain education systems are bad: Around the world, many children and adolescents -- 124 million, according to the latest figures from UNESCO -- are out of school and not getting any formal education at all.

In many cases then -- too many -- education systems aren't actually working all that well. In others -- like the global 'high performers' that are regularly held up as 'best practice' examples for other countries to emulate (Finland, Shanghai, Korea, Singapore) -- there is the danger that what worked well in the past (or what appears to be working well now) might not work so well in the future. The future is changing -- shouldn't we change the way we prepare for it? The riskiest course of action might well be one where people and institutions don't take risks.

Where business as usual is decidedly not working today, or where it is feared that business as usual may not work tomorrow ... what are some examples of business unusual from which we might draw inspiration -- as well as practical insight?

Many good examples of this sort are regularly cited from experiences in highly developed, industrialized economies of North America, Europe and East Asia. No doubt much can be, and will be, profitably learned from what is happening such places. That said, the challenges facing education systems and families around the world are particularly acute where the needs are greatest: in many low- and middle-income countries, and especially within remote communities and traditionally disadvantaged populations.

Examples of 'innovation in education' from such places might just be more relevant to policymakers in Phnom Penh or Quito than are ones which originate in, say Palo Alto or Cambridge. (And, it is perhaps worth noting, that, if you believe that innovation often arises 'at the edges', where constraints compel people to be inventive in their approaches to solving problems in ways that folks in more resource-rich environments may never consider, it may just be that policymakers in Paris and Canberra may learn something to learn from what's happening in 'developing countries' as well.)

**What examples do we have of innovative uses of educational technologies in such places?**

The **Center for Education Innovations** (part of the Results for Development Institute) has collected and published over 130 examples of educational technology initiatives in low- and middle-income countries. If you are looking for a quick tour d'horizon of what's happening in this area, the **project database** that CEI has assembled is a fantastic resource. **Simply stated**: It is the best illustrative, consolidated sampling of such programs that I know of. For those of you who just want the highlights, you're in luck: CEI last month released a **very useful short paper** [pdf] summarizing related key trends and spotlighting interesting projects, drawn from an analysis of this **database**.
While the CEI database is not comprehensive (one could easily imagine 130+ examples from India alone -- here there are only 29, and there is not one from countries such as Botswana or The Gambia), it is reasonably comprehensive in its variety, if that makes sense. Whether in formal schools or as part of informal learning activities, to help students prepare for specific school subjects or to network peers in support of teaching and learning or to track what is happening (or not happening) when it comes to schooling and learning, the CEI database provides scores of useful pointers to interesting things happening around the world -- including from what some people may consider to be the unlikeliest of wellsprings for new 'innovations in education'. Here one can find inspiration and insight about what is possible as well as practical lessons based on actual experience -- as opposed to prospective pronouncements by politicians or within conference PowerPoint presentations. There are 72 initiatives from Sub-Saharan Africa, with noticeable clusters in countries like Kenya (23 examples) and Nigeria (14).

CEI has identified five "key emerging themes and characteristics" across many of the innovative educational technology programs featured [in its database]. They are:

1. Providing increased access to learning materials through provision of technology
   examples: Kenya Computer Exchange; New Education Highway Free Learning Centres (Myanmar)

2. Delivering software and learning content for free or at reduced prices
   examples: Library for All (Haiti); Kytabu (Kenya); Train Your Brain (South Africa)

3. Offering instructional materials and training for teachers
   examples: Nokia Life+ (Nigeria); Technology 4 Education (Pakistan); UNETE (Mexico); Techniques for Effective Teaching Kit (Ghana); SoukTel PeerNet Service

4. Creating a platform around the world for students around the world to interact
   examples: FundDza -- Developing Young Writers Programme (South Africa); Nafham (Egypt); Connecting Classrooms (Liberia); PenPal Schools

5. Delivering lessons on skills for work
   examples: Shamba Shape Up (East Africa); W.TEC Girls Technology Camp (Nigeria); Edunova ICT Human Resourcing for Schools (South Africa); Digital Divide Data (Cambodia, Laos)
CEI also highlights three "emerging technology models" which it feels are promising:

1. Serving as school-in-a-box models
   *examples: Digital Schools in a Box (UNICEF); Bridge International Academies (Kenya)*

2. Giving instant student assessment
   *examples: Eneza Education (MPrep) (Kenya); Efiko (Nigeria); Tangerine*

3. Tracking and monitoring for accountability
   *examples: EduTrac (Uganda); Visiting Information of Schools Handled with Attendance System (VISHWAS) (India).*

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Browsing through the programs featured in the CEI database, I am reminded that there are really two general types of 'innovations in education', whether they originate from the 'bottom-up', are imposed from the 'top-down', or somehow sneak in 'from the side'.

The first type is the one most commonly considered: When something is done more efficiently, or cheaply, or faster, or at a wider scale, than has happened before. Innovations in education of these sorts are quite valuable and the most common. Improvement, iteration and expansion can drive progress in all sorts of useful ways, and doing what was done before, just better, is more likely to catch the attention of potential (traditional) funders and partners than more radical or 'out-of-the-box' approaches.

That said, there is another type of innovation in education worth considering: where the use of new technologies can enable something that simply wasn't possible (perhaps wasn't even conceivable) before. Such innovations are much more rare, of course, but it is precisely those sorts of innovations that can be truly transformational, possibly even (to use an overused term), 'revolutionary', for learners around the world.

We'll highlight lessons and experiences from a number of the programs and initiatives featured in the CEI database over the coming months on the EduTech blog -- as well as a bunch of other programs that aren't (yet) included, but certainly merit inclusion. Until then: You may want to spend some time poking around the CEI educational technology programs database yourself and/or clicks on a few of the links to related earlier posts on the EduTech blog below: There's a lot of great stuff going on that deserves greater attention!

*You might also be interested in the following posts from the EduTech blog:*
  - Educational technology and innovation at the edges
  - A short note to the new philanthropist looking to support education and technology initiatives in the developing world
• 10 principles to consider when introducing ICTs into remote, low-income educational environments
• A different approach to scaling up educational technology initiatives
  
  including these looks at specific 'innovative' projects:
• A new wave of educational efforts across Africa exploring the use of ICTs
• Bollywood Karaoke and Same Language Subtitling to Promote Literacy
• One Mouse Per Child
• Using ICTs in schools with no electricity
• Checking in with BridgeIT in Tanzania: Using mobile phones to support teachers
• An update on the use of e-readers in Africa
• Mobile Phones and Literacy in Rural Communities
• Interactive Radio Instruction: A Successful Permanent Pilot Project?
• Learning the Queen's English ... on your mobile phone?
• Promoting literacy with mobile phones in rural Papua New Guinea
• Next steps for Uruguay's Plan Ceibal
• Evaluating One Laptop Per Child (OLPC) in Peru
• Searching for India's Hole in the Wall
• A model for educational technology development from ... Afghanistan?
• Translating and implementing the Khan Academy in Brazil
• A Talking Book for Africa
• Evaluating the evaluating of the Millennium Villages Project
• Stuffing the Internet in a box and shipping it to schools in Africa

Note: The image used at the top of this blog post ("so many ideas ... are any 'out-of-the-box'?") is (c) Nevit Dilmen. It comes via Wikimedia Commons and is used according to the terms of its reative Commons Attribution-Share Alike 3.0 Unported license.
The OECD today released a landmark report on students, technology and learning based on data from PISA, the international assessment of 15-year-old school pupils' scholastic performance on mathematics, science, and reading. This new publication presents the most detailed set of data and analysis to date on student access to computers, their use of computers, and learning outcomes (as measured by PISA).

Students, Computers and Learning: Making the Connection
principal author: Francesco Avvisati
Paris: OECD, 2015

Here’s an excerpt from the beginning of a related blog post by the OECD’s Andreas Schleicher:

"Totally wired. That’s our image of most 15-year-olds and the world they inhabit. But a new, ground-breaking report on students’ digital skills and the learning environments designed to develop those skills, paints a very different picture. Students, Computers and Learning: Making the Connection finds that, despite the pervasiveness of information and communication technologies (ICT) in our daily lives, these technologies have not yet been as widely adopted in formal education. And where they are used in the classroom, their impact on student performance is mixed, at best."

Press reports today have (unsurprisingly) not been terribly nuanced or sophisticated in their understanding or analysis of what the OECD report actually says. Witness the Irish Times: "Ireland has one of the lowest rates of internet use in schools in the world but, ironically, it may be doing students more good than harm, according to a global study published on Tuesday" or the BBC: "Computers 'do not improve' pupil results, says OECD". The Register concludes that the main message is "Don't bother buying computers for schools, says OECD report". More sophisticated and substantive takes on these findings will hopefully emerge in the coming weeks. (I don’t know about you, but it seems to me that a more relevant,
and practical, directive might be to figure out how to make good use of all of this technology rather than simply to avoid it entirely, but maybe I am a biased observer here.)

My very quick summary take on a few of the key findings, for what it might be worth:

1. 'Computers' don't teach kids, teachers do (of course others do as well, including: peers; the students themselves; parents; etc.)
2. Mere access to technology makes little impact. Simplistic policies to buy lots of computers aren't terribly effective at doing much more than ... ensuring that you have a lot of computers.
3. There is a big disconnect between student use of computers inside and outside of schools.
4. Heavy use of computers by students often correlates to many things (lower performance, increased absenteeism, etc.) that aren't terribly desirable.
5. Education systems are struggling with all of this.
6. More generally, this publication (and many of the initial reactions to it) highlights to me the fact that most people tend to pose the wrong question when it comes to technology use in education. They ask: "What's the impact of computers on learning?" The most sensible answer to that query is, I think: It depends on what you use them for, and how, and why. [We'll explore some better questions to consider in a future EduTech blog post.]
7. This report documents that, in OECD countries at least, there is increasingly a lot of technology in schools. However, it may not be used all that much (and is certainly used less by students in schools than they use outside of school).
8. More importantly: It is clearly not being used terribly well. In aggregate, the mere existence of all of this tech isn't making much of a difference on student learning (as we measure such things today).
9. Given that we will live in an increasingly technology-saturated world, a key challenge for education systems will be how to use this stuff effectively, safely and equitably.
10. Indeed: Few imagine a future in which there is less technology in our lives, and in our schools. Few would argue that potential uses of new technologies don't hold great promise for student learning. The challenge is: How to make this happen.

Buried in the report are lots of quite interesting, and potentially policy-relevant, data and insights -- such as the fact that, in many schools, technology use appears to be enabling pedagogical approaches that aren't as much in evidence when technology is not utilized. (We'll examine at some of these sorts of insights in a later EduTech blog post.) Identifying and learning from such pockets of activity (and innovation?) should be a priority for policymakers and researchers going forward. The OECD report comments that “adding 21st-century technologies to 20th-century teaching practices will just dilute the effectiveness of teaching” and that “it is vital that teachers become active agents for change, not just in implementing technological innovations, but in designing them too.” That seems about right to me.
One phrase that I did not find in the report, nor during today’s webinar announcing its key findings, was ‘learning curve’. From my perspective here at the World Bank working with governments on related issues, it seems pretty clear that many education systems around the world are facing a rather steep learning curve when it comes to making effective use of their (often rather large) investments in educational technologies – and presumably will do so going forward as well.

For those interested in such things (a category to which a good many readers of the EduTech blog presumably belong), *Students, Computers and Learning* is well worth reading. If you don’t have time for the whole report (it’s pretty long), I suggest you at least read the executive summary – and not many of the related press reports that cherry pick from the summary to provide sensational headlines. There is a lot here that’s worth considering.

**Some related materials:**

- "Students, computers and learning: Where’s the connection?" (blog post from Andreas Schleicher)
- "School technology struggles to make an impact" (BBC article by Andreas Schleicher)
- "New approach needed to deliver on technology’s potential in schools" (OECD press release)
- PPT from Andreas Schleicher
- Download the data sets
- PISA Focus Brief on "Who are the best online learners?"
- Today’s webinar today was recorded and should be released shortly on the OECD education site (URL unknown, your best bet is to look here; I’ll tweet it out once it’s posted via @trucano for anyone interested, I expect @SchleicherEDU will do so as well).
- On a related note: During today’s webinar, Andreas Schleicher observed that, “We live in a world that is hostile to school innovation.” Look for a new report from the OECD on *Innovative Learning Environments* later this year. And, in case you missed it, you may also wish to check out last year’s report from the OECD on *Measuring Innovation in Education*.

*Note:* The image used at the top of this blog post of a girl at the Guimet Museum in Paris ("OK, I think I’m developing the outline of something pretty interesting here") comes from the French Wikipedian Kezia1 via Wikimedia Commons. This copylefted work of art is free; you can redistribute it and/or modify it according to terms of the Free Art License.
I began my career exploring the uses of information and communication technologies (ICTs) in education in Ghana, Uganda and a number of other places in Africa in the late 1990s, and have continued to stay engaged with lots of passionate and innovative groups and people working with ICTs in various ways to help meet a variety of challenges related to education across the continent. Because of this history, and continued connections to lots of folks doing related cool stuff, I am from time to time asked:

"So, what's happening with technology use in education in Africa these days?"

Periodically one comes across press reports asking general questions of this sort, such as this one from Germany's Deutsche Welle news service: *Can tech help solve some of Africa's education problems?* Of course, 'Africa' is a rather large place. Related generalizations (while catnip for headline writers, especially those outside the continent) obviously can obscure as much as they illuminate, perpetuating certain stereotypes of Africa as a single, monolithic place with certain common characteristics. (Binyavanga Wainaina's satirical *How To Write About Africa* remains sadly spot on in too many instances.)

That said, while the impulse from some corners to refer to 'Africa' may be both unfortunate but nevertheless predictable, being asked this sort of question at least provides an opportunity to unpack this question in ways that are (hopefully) useful and interesting. The EduTech blog was conceived in part, and in a decidedly modest way, to help direct the gaze of some folks to some of the interesting questions and challenges being addressed in different ways in different communities in Africa related to ICT use in education by groups who are, along the way, coming up with some interesting answers and solutions.

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The UNESCO Institute for Statistics (UIS), the arm of the United Nations charged with collecting global data related to education (and some other sectors as well), recently came out with a report that provides some useful data that collectively can help outline the general shape of some of what is happening across the African
continent when it comes to the availability and use of educational technologies. *Information and Communication Technology (ICT) in Education in Sub-Saharan Africa: A Comparative Analysis of Basic e-Readiness in Schools* is certainly not the first such report that has taken a continent-wide perspective, but it is notable in a number of regards -- not only because it is the most recent such effort, but also because it is intended as a precursor to more regular data, systematic data collection efforts going forward.

Written by Peter Wallet (with the assistance of Beatriz Valdes Melgar), the report presents data and related analysis from a survey co-sponsored by UIS, the Korea Education and Research Information Service (KERIS) and the Brazilian Regional Center for Studies on the Development of the Information Society (CETIC.br -- the group responsible for the annual *Survey of ICT and Education in Brazil*). The report notes that, unfortunately, "data on ICT in education in the region are sparse. Collecting more and better quality statistics will be a priority in the post-2015 development agenda given the growing role of ICT in education. In response, the UIS is working with countries to establish appropriate mechanisms to process and report data, and to better measure the impact of technology on the quality of education." With that caveat and announcement out of the way, the report then utilizes the UIS *Guide to Measuring Information and Communication Technologies (ICT) in Education* as a framework with which to examine what could be discovered about the existence of related national policies, data about learner-computer ratios, school electrification and connectivity, and ICT-related instruction and curricula in ways consistent with other regional reports that the UIS has published on Asia, Latin America and a number of Arab countries. (Here's a list of international surveys of this sort from UIS and others for anyone who might be interested, as well as some general information about efforts of this sort.)

*Some selected highlights:*

- UIS finds that the "most significant obstacle in measuring ICT in education in sub-Saharan Africa is the lack of systematic data collections", noting that a number of countries (e.g. Somalia, Benin, the DRC) reported that there was no systematic related data collection *at all* in their countries. UIS states that the existence of a data collection effort related to this topic (not surprisingly) often correlates with whether or not ICT use in education is considered a priority area of policy and investment interest in a country and that, generally speaking, "ICT use in education is at a particularly embryonic stage in the majority of countries in sub-Saharan Africa."

- Based on information from the African countries who reported information back to UIS (which, it is worth noting, focused on sub-Saharan Africa, plus Djibouti), UIS reports that, in general, "computers are more frequently available for secondary education" (i.e. based on enrolment), which might reflect the tendency to prioritise ICT in secondary education curricula compared to primary education". While generally speaking very high, learner-computer ratios (LCR) vary widely, both within a given education system (in The Gambia for example, the LCR for upper secondary is 37:1,
compared with 277:1 in primary education) as well as across countries. Upper secondary LCR in Madagascar is 500:1, while in Rwanda it is 40:1 (at both secondary and primary levels, a legacy of the One Laptop Per Child project there). In addition to Rwanda, the lowest LCRs recorded are in Mauritius (23:1 in primary and 19:1 in upper secondary) and Botswana (55:1 in primary, 17:1 in upper secondary). School computer labs are quite common in many countries.

- **Internet connectivity for schools is also notably scarce**, with a few very notable exceptions. Figures below 5% (and sometimes effectively 0%) in places like Niger and Liberia contrast with situations found in Botswana and Mauritius, where virtually all schools are connected. (An aside: It is worth noting that, everywhere schools are connected, sufficient bandwidth can be a big issue.)

- One big constraint on the use of ICTs in education in many countries is basic **access to sufficient electricity**. Across many countries (e.g. Uganda, the DRC), fewer than one in twenty schools have electricity, although 75% of primary schools in countries such as Botswana and South Africa have electricity, as do all primary schools in places like the Seychelles and Mauritius (the clear outlier in most categories here).

The UIS paper concludes by noting that "**Collecting more and better quality statistics from sub-Saharan Africa will be a priority in the post-2015 development agenda as ICT is expected to play an increasing role in future education goals....** Understanding that ICT resource inputs alone are inadequate for understanding the impacts of ICT on student outcomes, additional data on usage are required – more specifically data on how, when, how much and where teachers and pupils use ICT." (I might add why to this list of interrogatives as well.)

*Congratulations to the team at UIS that is taking the lead on these activities, which will help set a baseline against which related future developments across Africa can be measured.*

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The UIS survey data collection initiative was not the first survey of technology use in education across Africa, of course:

- Back in 2007 when I was with the World Bank's infoDev program, we published two volumes of results from 53 country-level surveys of what was happening in each country in Africa and a more general synthesis of these findings. The information collected varied a great deal in comprehensiveness in quality, but at least it was a start. Indeed, we wrote at the time that, "This Survey of ICT and Education in Africa seeks to gather together in a single resource the most relevant and useful information on ICT in education activities in Africa. We hope that this publication is a first step in a larger, ongoing, systematic, coordinated initiative to track developments in technology.
use in the education sector to help inform a wide variety of stakeholders interested in the topic as they seek solutions to larger, more fundamental educational and development challenges in the years ahead." (A subsequent World Bank report, eTransform Africa, extended this initial work.)

- **eLearning Africa**, the annual conference which has for many years been an epicenter of information sharing on ICT use in education on a continent-wide basis (African Brains has been attempting to do something similar), publishes a very useful *eLearning Africa Report*, which is described as "a yearly snapshot of progress and perspectives in the field of technology-enabled learning across the continent. Combining news, features, interviews, literature, survey results and [...] an extensive reference section, it is the most comprehensive guide there is to the facts, experiences and opinions that lie behind ICT4E and ICT4D developments today." (Here are direct links to the reports in 2015; 2014; 2013; and 2012.)

- There can be no denying the explosive growth of mobile phones across Africa over the past decade -- something which is not expected to slow down any time soon. To what extent might these sorts of devices be relevant to discussions related to education? UNESCO has produced two useful related publications, documenting programs and activities related to *Mobile Learning for Teachers in Africa and the Middle East* as well as a more general volume, *Turning on Mobile Learning in Africa and the Middle East*.

- The database on educational technology programs maintained by R4D's **Center for Education Innovations** (recently profiled on the EduTech blog) contains information on 73 projects across the continent.

- **Some quick history, and some other useful sources of information**: For what it's worth, around the dawn of the new millennium, a number of efforts -- including a series of papers on edtech in Africa supported by the **World Bank** and as part of Dfid's **Imfundo** research programme -- helped provide some of the earliest systematic documentation around ICT/education projects and issues not limited to a single country. **Schoolnet Africa**'s Africa Education Knowledge Warehouse was for many years a go-to source of related information. The **Commonwealth of Learning** and **SAIDE** have also been notable groups documenting ICT/education efforts across the continent, especially related to distance learning, as have organizations like **GeSCI** and **IICBA**. The **NEPAD e-Schools Initiative** was one early attempt at a multi-country project across countries in Africa, as was the **African Virtual University**, which has emerged from a number of pivots and incarnations as an innovative actor exploring ICT use in education in various ways with partners across the continent.

While initial efforts related to technology use in education in many African countries were supported (and indeed instigated) by outside donors, NGOs and funders, it is notable that today there are increasing numbers of programs conceived locally and led by local groups. While in many cases still small and facing
many challenges (related to access to capital, for example, and sometimes cultural perceptions around entrepreneurship), there are dynamic start-up scenes emerging in many spots in Africa (*SmartMonkeyTV* is one place to find interviews with participants in some of them), with innovative, passionate and talented people exploring edtech-related business ideas that are closely attuned to local market needs and realities. Informed by local know-how and experience, many of these projects have benefitted from learning from lessons from good (and bad) practices in other parts of the world, and I would not at all be surprised if many of the approaches and 'solutions' that emerge as a result of innovations from such groups and things like *MakerFaire Africa* help to suggest ways forward for their counterparts in other parts of the world while, more importantly, improving things in noteworthy and measurable ways much closer to home.

*You may also be interested in the following EduTech blog posts:*

- A new wave of educational efforts across Africa exploring the use of ICTs
- eLearning, Africa, and ... China?
- An update on the use of e-readers in Africa
- eTransform Africa
- Evaluating the evaluating of the Millennium Villages Project
- A few myths and misconceptions about digital teaching and learning materials in Africa
- Education & Technology in Africa: Creating Takers ... or Makers?
- Educational technology and innovation at the edges

*Note:* The image used at the top of this blog post of a Verner compass ("I have a better sense of where things are today, but the more important question is: Where are things headed?") comes from *Ted Brink* via *Wikimedia Commons* and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license.
Video games, screen time and early childhood development
by Michael Trucano
#17: originally published on Friday, 2 October 2015

At 9:00 am this past Monday morning, almost 30 people crammed into a small conference room at the World Bank in DC to talk about ... videogames. (A good number more were queued up online to join in, but unfortunately technical snafus prevented them from participating -- our continued apologies if you count yourself among that group.) The featured presenter at this discussion, my colleague Mariam Adil ("Meet the Woman Who's Shaking Up Pakistan's Social Gaming Industry"), the founder of GRID (Gaming Revolution for International Development), shared some of the interesting and innovative things she has been doing to help create and roll out a number of educational mobile apps, as a contribution to broader discussions on topics related to 'early childhood development' (ECD).

Providing children and their caregivers with access to quality pre-school education opportunities is a primary activity of the World Bank's work related to early childhood development. No one who participated in Monday’s discussion expressed the view that 'technology is the answer to the challenges of ECD'. That said:

*Are there approaches and activities related to early childhood development worth pursuing that can be complemented, and in some cases helpfully enabled by, new technologies?*

As the related World Bank strategy states, "Investing in young children through ECD programs—ensuring they have the right stimulation, nurturing and nutrition—is one of the smartest investments a country can make to address inequality, break the cycle of poverty, and improve outcomes later in life."

Given the proliferation of mobile phones in communities around the world, there can be no denying that such things are increasingly in the hands of parents and caregivers (and, for better or worse in the hands of children as well, both briefly and for extended periods of time).

*What are we learning about what is possible, and what is useful, to do with these devices that can complement and extend many ECD activities and programs?*
Deliver information and services to people where they are, don't make them come to you' -- this can be a rather useful approach to helping meet many of the inter-related objectives common to early childhood development programs. And: Like it or not, increasing numbers of caregivers are to be found via their mobile phones. As Jan Chipchase observed many years ago in a presentation to the World Bank, for a good number of people around the world (and for better or for worse), the last thing they touch each night before their head hits their pillow is not their spouse or children, but rather their phone.

Traditionally, and currently, most such phones in most so-called 'developing countries' have been 'dumb phones' or 'feature phones' with limited functionality, but this is now starting to change in earnest. While we may not (yet) be at an inflexion point when it comes to access to and the affordability of smartphones in most poor countries, such a point may slowly be coming into sight in many places around the world. Myanmar, most of whose citizens have until recently not been able to access mobile telephony, was recently predicted to be the world's first "smart phone first" country. The first quarter of this year saw more smartphones shipped to Africa than feature phones.

This isn't to contend that (just to cite a random example that I made up ... or did I?) developers sitting in Silicon Valley developing a smartphone app for young mothers in poor communities in Kenya optimized for devices running iOS9 are likely to find that their target demographic is able to use their application, no matter how whizz-bang or 'revolutionary' it may be. While recognizing the large installed base of feature phones around the world and that active trade in second hand feature phones means that such devices will continue to outsell smart phones across the continent for a while, it is nevertheless also becoming clear that initiatives to develop apps for smart phone users in many communities in developing countries aren't as crazily off-target as they used to be.

During the course of her presentation on 'Games for Parental Education', Mariam commented that "parental engagement and stimulation during the early years of a child’s life are critical to set the child on a positive lifelong trajectory". With this context in mind, she explored a number of the ways that games, and 'gamification' (the use of game design elements in non-gaming contexts) more broadly, can help promote increased engagement in activities meant to promote early childhood development by targeting caregivers, or groups that work directly with them. Citing a common use case scenario for many 'casual games' -- that people in advanced economies play on their mobile phones while waiting in line to do something (at a store, at a government office, etc.) -- she hypothesized that such use cases may be especially relevant in many low income countries in developing countries where waiting on line is an even more common occurrence. (I'll note parenthetically that she acknowledged a number of cultural conventions and practices that may complicate such scenarios in many places -- context is always king.) Might the use of mobile games provide one way to engage with
caregivers, briefly but in a constructive way, and share information that might be helpful for the development of children in their charge?

Of course, merely because something comes wrapped in the bright colors and blinking icons of a videogame doesn't mean that it will necessarily be engaging. In too many cases, the defining characteristic of an "educational video game" is that it is not fun to play. But the potential is there.

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While the potential to use video games and game-type approaches to help meet some goals common to many ECD-type programs, especially where such use can complement and extend other activities, the trick is of course in the 'how'. Many international donor and aid agencies are recognizing the potential utility of things like mobile phone games within some of their related projects but face a number of challenges when trying to realize this potential in practice. Generally speaking, however: They don't have much related in-house experience. They don't (yet) have the expertise to manage such efforts terribly well, nor cost them out, let alone the technical chops to do this stuff themselves. (Within the World Bank, examples like GRID or EVOKE are notable outliers, exceptions that prove the rule.) They don't know the landscape of developers and providers. They don't (really) know users either, or to be more specific: they don't understand usage contexts or constraints. It's possible to make some informed guesses, of course, which can provide an important starting point for action, but if you're pointed in the wrong direction, using technology can help get you there more quickly. Most successful app development is a result of a highly iterative development process, something that traditional donor practices, which often can be notably 'traditional', risk-averse and which insist on clearly pre-defined and immutable metrics for 'success' upfront, can make rather difficult. Such capacities and capabilities will inevitably be developed over time, but in the meantime no doubt some mistakes will be made (and there will probably be a few spectacular failures along the way). One reality that many donor groups, headquartered in highly developed OECD countries, are only slowly becoming aware of is the number of folks doing mobile app development within middle and low income countries. While such groups may not themselves be good proxies for the types of caregivers targeted by donor aid supporting ECD, they are a lot closer to them than are game developers in, say, Tokyo or Tampere, Berlin or Brooklyn.

I regularly hear that donor support for the development of mobile apps can be very cost-effective because 'they scale up easily'. Once games are shown to be 'effective' (however that may be defined), their digital nature and the increasing ubiquity of mobile networks suggest, or so I am told, that 'distribution is relatively simple'. Maybe. In my experience, distribution of mobile apps to end users in many
low income communities in poor countries can be a real challenge. I find myself regularly reminding people that, for example, the Apple AppStore is not a terribly relevant distribution option in most of the developing world. All flavors of Android are not the same. People may not be used to downloading and installing apps themselves -- nor might they want to spend their precious mobile minutes on such activities. For these and other reasons, it can often be useful to target intermediaries (like the folks in local markets who, in addition to selling pre-paid minutes and used phones, offer to download content onto someone’s phone for them for a small fee, who repair phones and provide software updates, etc.) who can serve as key nodes in any sort of distribution scheme.

As with any endeavor, understanding what you want to accomplish, understanding your users and beneficiaries, as well as the relevant "use cases", is key. Development efforts informed by co-creation, and which take place as close to the user as possible, are more likely to meet with success (or at least make it easier to identify failure more quickly so that you can learn and try something different). As with other initiatives that utilize information and communication technologies, the digital data trails generated through the use of mobile phones can present a treasure trove of information for researchers, while at the same time giving rise to all sorts of privacy concerns. While the potential use of mobile devices to help expand what is possible when it comes to support programs related to early childhood development is undeniable, and indeed even exciting in certain instances, it is important not to get carried away. Kentaro Toyama eloquently cautions in his book *Geek Heresy* that "Technology — no matter how well designed — is only a magnifier of human intent and capacity. It is not a substitute." Absent such intent and capacity, efforts to explore and promote the use of games for parental education and to support early childhood development, however well-intentioned and shiny, are unlikely to amount to much.

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Almost none of Monday's discussion discussed the potential use of mobile games by young children themselves. While the 'pass-back effect', where parents hand their phone to a child to occupy him or her while a parent is engaged in doing some else (driving, checking out at the supermarket) was first observed in circumstances in 'highly developed' countries, the phenomenon isn't limited to such environments. However one feels about such things, this is a reality that is hard to deny. There is much we don't know about the effects of 'screen time' on young children, and related conversations are, in my experience, typically informed more by speculation, personal experience and emotion than they are by 'science' (although related 'pseudo-science' may often be invoked in seemingly authoritative ways and findings from 'research' may be cited in ways that are rather, um, problematic). There is no shortage of good (and bad) resources available on the Internet to become informed about such things (for what it's worth, here is the most current related factsheet from the World Health Organization on "Electromagnetic fields and public health: mobile phones") and I don't intend to wade into related debates here.
That said, it is worth noting that this week the American Academy of Pediatrics updated its official guidance related to "promoting positive media use and discouraging potentially harmful use". Back in 2011, the AAP released a widely-cited and influential policy statement which discouraged screen time for children under the age of two and advised that screen time be limited to two hours a day for children over the age of two. Earlier this year the AAP brought together pediatricians, researchers, cognitive neuroscientists, educators and others to discuss the current state of related research, practice and informed opinions and has now released a set of key messages for parents. Noting that "Media is just another environment" and that "children do the same things they have always done, only virtually", the AAP provides some quite common sense and practical advice based on emerging research. (Some examples: "Passive video presentations do not lead to language learning in infants and young toddlers. The more media engender live interactions, the more educational value they may hold." "Content matters" and "co-engagement counts".) Combined with similar sorts of guidance from the (U.S.-based) the National Center for Infants, Toddlers and Families and other responsible groups, it is clear that our related understanding is becoming more nuanced than the blanket "no screens" directive that is increasingly impractical in many contexts. That said, when it comes to these sorts of things:

There is still a lot that we don't know.

For those looking to make sense of what we do know, Tap, Click, Read, a just-published book and website from Lisa Guernsey and Michael Levine, might be worth checking out. There is some really great stuff here: Clear, easy-to-read, practical, nuanced, hyperbole-free and informed by evidence. (Such a combination of modifiers is regrettably rare to encounter in books and discourse about technology and learning, imho.) That said, it is worth noting that much of what we do know, or purport to know, arises from research in rich and 'highly industrialized' countries, and as a result of interactions with certain user communities in such places. As 'screens' and new technological devices continue to become increasingly available across societies, even in some of the poorest places and among people in the poorest and least advantaged communities, the extent to which lessons from such 'developed' places are relevant to the conditions of young children and their families and caregivers in 'other' parts of the world will be an increasingly important area of research attention in the years to come.

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Monday's discussion was the first in a miniseries of talks at the World Bank exploring what is known about approaches to utilizing new technologies as part of projects designed to help meet objectives related to early childhood development. We'll highlight messages and debates that arise during discussions at future events in later posts on the EduTech blog.

You may also be interested in the following posts from the World Bank EduTech blog:

- Videogames and Learning
• What Sesame Street Can Teach the World Bank
• Mobile Phones and Literacy in Rural Communities
• four blog posts on EVOKE, the on-line educational game sponsored by the World Bank

Note: The image used at the top of this post of a toddler scrambling after some blocks ("there must be a screen here somewhere, where could it be?") comes from D Sharon Pruitt via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution 2.0 Generic license. The second image of a lady looking at her phone ("30 million words: how many text messages is that?") comes from Biswarup Ganguly via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license. (The oblique reference is to this groundbreaking study.)
Many critics of contemporary schooling practices have noted that, if a teacher from the 19th century was magically transported into a typical classroom today, she would feel very comfortable with how things look. The room itself would be very familiar.

(Whether that teacher would be comfortable with today's students is another matter entirely, given that they probably look a little different than they did 'back in the day' -- to say nothing of how they might act and some of the opinions they might have!)

Contrast this, such critics note, with the situation of a surgeon from the 19th century teleported into an operating room today -- he would be bewildered, and perhaps disoriented, by all of the technology on display.

Few would deny that, in many fundamental and obvious ways, technology has revolutionized medicine and healthcare.

*Why hasn't it done so (yet) for learning and education?*

One way that critics illustrate and reinforce this question is to share pictures of 'typical' operating rooms in the 19th and 21st centuries, alongside pictures of 'typical' classrooms from both centuries. The classrooms in such examples usually do look quite the same, with a teacher standing at the front of the room and neatly lined up rows of students intently (if metaphorically) drinking from the fountain of the teacher's knowledge. The chief noticeable difference (again, apart from the students themselves -- and the teachers as well) is that there are now computing devices of some sort on display in the 'modern' classroom, sometimes (depending on the country) lots of them, although the room essentially looks and functions the same way. The arrangement and nature of these ICT devices don't fundamentally alter the architecture of the room, nor what occurs inside it. In others words, the changes are additive, not transformative. (It is of course possible to provide pictures of some of today's 'innovative' classrooms that complicate this simple and popular narrative, as well as to ask some fundamental and important questions about what such pictures may obscure and what they illuminate, but I'll ignore such inconvenient complications here.)
Side note: Over a dozen years ago I visited the launch of a computer lab at a school in Cambodia. The headmaster had proudly transformed a room formerly used for sewing instruction into a 'technology lab', with a new PC atop each desk in place of the 'old-fashioned' technology of the sewing machine, with neat rows of students facing forward toward a teacher who was energetically shouting instructions.

Let's also put aside for a moment whether all of this technology 'makes a difference' (as well as perhaps more relevant questions about how and under what circumstances ICTs have an 'impact'). Let's ignore discussions about whether or not today's classrooms are a legacy of a 'factory model of education' that once existed but is no longer useful, or about the potential need to re-think school architecture in the age of ICT. Let's also ignore related 'big picture' issues around policymaking and planning.

Let's focus instead just on the technology itself.

Many regular readers of the EduTech blog are no doubt familiar with scenes of ICT equipment sitting unused in schools, locked away in computer labs or even still resting peacefully (and undamaged!) in unopened boxes. Often times, getting teachers and students to use such equipment, let alone to use it 'productively', can be a rather tall order, for all sorts of reasons. Nevertheless, education ministries, local educational authorities, and schools around the world are buying lots of technology: PCs, laptops, tablets, projectors, and lots of other devices and peripherals.

What are they doing to make sure that this stuff doesn't get stolen?

No matter how strategic an investment or policy on technology use in education might be, and whatever side of the fence you find yourself on related to whether or not ICTs in education are 'worth it', there is little disagreement that such purchases are indeed *never* worth it if the equipment itself is stolen. You can't use this stuff if it isn't there. (Nor, it should be noted, can you use this stuff if it is there but not usable or accessible, but that's another issue.) Increasingly, the most valuable parts of a education system's IT infrastructure will not be found in the physical equipment itself, but rather in the data transmitted across and stored in the system at various levels and places. That said, as numerous recent news reports from countries around the world demonstrate (here's one from South Africa, for example), securing the equipment itself remains a rather important and acute challenge for many schools and education systems.

For what it's worth, and based on conversations with government officials, IT personnel, vendors, teachers and headmasters and visits to hundreds of schools rolling out ICTs over the past decade in scores of countries, rich and poor, and in urban, rural and suburban environments, here are:

Ten common (and a few uncommon) approaches to preventing the theft of computers, laptops and tablets in schools around the world
1. Lock it down and/or chain it up (physically)

For all of the (important) talk, policymaking and planning related to computer security within education systems, of preventing things like data theft, identity theft, and unauthorized access to networks, systems and data (all areas where almost all education systems could do *much* better, in my experience), in lots of places there is still also a lot that needs to be done to combat the old fashioned kind of computer theft: when people just pick up something that doesn't belong to them and walk away with it.

One obvious way to help prevent this sort of thing is pretty straightforward, and so most schools do it to varying degrees -- they buy and install lots of locks, of various types, in various places. For example, it is quite common to see schools do the following things in order to protect ICT equipment from theft:

- Lock the door to the room where ICT equipment is kept.
- Lock the windows and/or put bars on them.
- Designate a special storage room for ICT equipment. Store equipment there when it is not in use -- and lock the room!
- Install (and use) specialized physical locks for desktops and laptops and other equipment (e.g. locking desktop PCs to the desks on which they sit).

One argument often made *against* the purchase and use of devices like laptops and tablets in schools has been that the small and portable nature of such devices make them especially vulnerable to theft. This holds true for smaller devices as well: phones; interactive voting devices, or 'clickers'; probeware and sensors that can be connected to such devices, etc. Fair enough! But such things are presumably not going to go away nor become less useful any time soon (nor presumably will the increase in size). Within classrooms, charging stations for laptops or tablets can also serve as secure storage for a variety of devices.

It is worth noting that chargers themselves may be attractive targets for theft -- as well as non-ICT equipment that is vital for the use of computers in many places (the fans and air conditioners that help keep computer labs cool, for example).

Less attention is sometimes paid to the security of devices while they are in transit within the school. Some schools transport laptops or tablets between rooms using a dedicated mobile carts (sometimes referred to as COWs, or 'computers on wheels') which can be locked -- and lock up the carts in a separate room when they are not in use. (One side note about COWs: Because these things can be used by thieves as a convenient means by which to take lots of your laptops out of your school...
quickly, you may not want to store them near the entrances to the school -- and you may want to consider ones where the wheels can be locked.)

2. **Lock it down and/or chain it up (electronically)**
In addition to physical measures to prevent theft, a variety of electronic measures are possible.

At a basic level, requiring the people log into machines before they can be used is almost always a good idea. There are many ways this can be done, which provide different levels of security (at the level of the operating system, the BIOS, etc.).

It is possible to create electronic 'ring fences' around schools (or parts of schools), so that if computer equipment leaves this area, it no longer functions (in whole or in part).

It is also possible to remotely disable computers, should they be reported stolen (provided they connect to the Internet somehow, of course). Alternatively, it is possible to require that the computer connect to the Internet or a network at certain intervals in order to keep functioning fully.

Such measures don't always really prevent the physical theft of equipment, of course, but they make the equipment itself much less valuable, in that it can't be used once it is stolen. Of course, there are potentially ways around such electronic 'locks', depending on how good they are and the sophistication of the thieves. And: Thieves who are unfamiliar with such measures may not be deterred from stealing equipment in the first place (even if there are later unable to use or re-sell it).

3. **Hide it -- or at least obscure it**
No matter how many (or how few) physical or electronic/digital 'locks' you have on equipment, there are a number of simple and low cost ways to make theft less likely. Storing equipment in inaccessible (or less accessible) places (like a locked computer room) is of course one example of this, but there are many others as well. Simply closing the shades (and not placing equipment near windows) can help. Places tablets in desks or laptops on computer carts when they are not in use can help. Leaving empty computer boxes stacked outside the school after new equipment is delivered essentially advertises to potential thieves that there is something in the school that might interest them -- don't do this!

There are many other potential signals to thieves that computers are in the school -- and where they might be. In many hot climates, the presence of air conditioners attached to windows for some rooms, but not others, may suggest where the computer room might be. Bars on the windows and locks on doors can send similar signals.

If you have a choice, not locating school technology labs or computer storage rooms on the ground floor or near the front entrance of the school can be a wise choice.

*(Side note: In some schools and district education offices, the rooms which were previously used to 'safely store' textbooks -- which may as a result*
have gone unused in some cases -- have been converted to 'safely store' computers -- which, as with the textbooks previously, then also remain unused.)

4. Take special care after hours, on weekends and during school holidays
It should be obvious that it might be useful to consider different approaches to security when school is in session, and when it is not.

During long holidays, many education systems physically repossess many devices in schools so that they can be stored safely in a central, secure location. At this time they can also do a number of other things, including take a general inventory, update software and load new content, as well as make any needed repairs.

It is perhaps worth noting that the transportation of equipment between schools and district/ministry offices for safekeeping can represent a particularly opportune time for thieves to strike, so plan accordingly.

5. Keep an accurate and up-to-date inventory
It can be easy for equipment to disappear if you don't have a record that you have it. Keeping accurate and up-to-date lists of your inventory can help you quickly identify when things may have gone missing. Also, the fact that you take such inventories regularly can signal to potential thieves within your schools or education system that you are paying attention!

Keeping track of serial numbers is standard practice in most places these days (and something that should always be done). Affixing bar codes to individual items and then using scanners to assist with the inventory process is increasingly common as well. (A side note about scanners: You might consider using a mobile phone app instead of buying separate scanners, which break down, go missing, or even get stolen themselves. One clever way for insiders to facilitate regular small-scale theft is to 'lose' the scanners, which makes it difficult to keep up-to-date inventories; by the time new scanners are procured and delivered, some of the equipment may be long gone.) RFID tags are increasingly in use in some education systems as well.

Note that this issue of inventorying can be complicated in practice in many instances by the phenomenon of schools keeping multiple sets of 'ICT ledgers'. I have visited more than one school that keeps an inventory list that it shows to the central ministry which only includes the equipment that was centrally provided, omitting equipment that was e.g. donated locally, purchased by parents, bought by the school itself and/or provided by local educational authorities. Schools may be disinclined to include equipment obtained via other means on the 'official' list, as they might worry that this would signal to the central authorities that they may not need additional equipment. I once spoke to a school IT administrator who kept separate lists that he showed to the parent-teacher association, the district education office, a local philanthropic donor, and the national education authorities. The actual master list was a closely guarded secret, only shared with the school principal.
In addition to taking physical inventories, you can take 'virtual inventories' at a distance as well. If, for example, a device hasn't logged onto the network for a long time, you might want to investigate.

Make sure that you keep your inventory lists in a safe place -- and have back-ups. If someone steals your list, you might be in trouble! (And: Do you really need to publish your inventory list on your school web site in a place accessible to the public?)

6. Watch over it closely

People are an important part of any an approach to preventing the theft of ICT equipment of schools. Posting guards outside computer facilities is an expensive or drastic approach, but, where there are guards in schools already (for better or for worse), instructing them to pay particular attention to places where computer equipment is found is a rather good idea.

Installing security cameras can help (although even considering this sort of thing should bring up larger questions about 'surveillance' in schools), whether the resulting video feed is viewed within the school itself or at some remote location. Cameras that aren't actually connected to anything can even provide some level of deterrence. (I have been in schools where they took old web cams and pointed them at the technology room. "These don't actually work", an IT guy at a school once told me, "but the kids and teachers don't know this!")

As mentioned, conducting regular inventories can be an important way to help monitor equipment.

While it may not prevent the theft of equipment (especially if thieves don't know it has been installed on devices), tracking software ('find my phone' is one well known example of this general type of thing) can potentially help you figure out where the equipment it after it has been stolen.

Alarms (on doors, on equipment) can help alert people to where a potential theft may be in progress or has recently occurred.
Designating teachers (or even students) with special responsibility to make sure equipment is not stolen can be another useful, low cost way to help prevent theft. (If no one feels responsible for ensuring that equipment doesn't disappear, no one is responsible as a practical matter.)

7. **Know who has the key(s)**
Your security plan should include attention not only to where the equipment is, what it is, and who is looking after it, but also who has the keys (and master passwords) that can provide access to it. Change keys and/or passwords at regular intervals, as might be possible/appropriate/affordable. Have a policy about key possession, use and duplication and the access to master passwords -- and the storage of 'extra' keys.

*Side note:* A clever thief may use a key and then break a door only once he is leaving, as a way to throw suspicion away from people who have access to the keys. While a heist is in progress, a broken door would certainly suggest to passersby that something might be wrong.

The people who know best how to steal your equipment are probably those who work with it most often. Here's an exercise to try: Ask them where there are holes in the security procedures and systems. IT people are often especially good at 'hacks', both physical and digital. Ask some of them how to hack your security and then plan some related defensive measures. (Education systems in rich countries may hire an outside security firm to do 'penetration testing', i.e. engage a group that tries to steal equipment so that education officials can learn what isn't working and make any needed changes to their policies, practices and procedures. This remains relatively rare in most places, of course -- although, where related insurance is available, this might be a function that could be performed by the insurance company).

8. **Make it look distinctive**
Where countries procure very large numbers of educational laptops or tablets at a national or regional scale, ministries of education may wish to consider requiring the manufacturer, assembler or distributor to ensure that the devices looks distinctive in some way. (Maybe they have a red cover, for example, or a picture of national flag on them.)

Even where the equipment itself doesn't look distinctive, it is quite common for logos to be burned, embossed or etched into equipment marking it as e.g. property of an education system or school and/or for stickers (less permanent, obviously, but better than nothing) with the same message to be affixed to the equipment.

*Side note:* When the OLPC XO (the famous "$100 laptop") was first being marketed, some of the leaders of the sponsoring organization liked to note that the design of the little green and white devices was so distinctive that, if they were stolen and made available for re-sale in local markets, people would immediately know that these had been stolen from schools, as there was no other way to get them, which would help with theft prevention.
(Based on anecdotal evidence, I believe that this was often actually been the case.) I have heard proponents of the use of iPads in schools in very poor countries where the devices were not sold in local markets make similar claims. (What making such arguments, OLPC folks sometimes referenced the appearance of postal trucks in the U.S. "No one steals postal trucks in the U.S.," went the argument, "because they are so unique and easily recognizable by everyone". I always thought that this was a clever comment ... even if the metaphor was often not immediately understood by policymakers in other countries who were not at all familiar with the distinctive jeeps used by the U.S. Postal Service with the steering wheel on the 'wrong side'!)

9. If you don't own it, they can't steal it from you

One way for schools not to have computer equipment stolen is not to own any of it in the first place - or to own as little of it as possible. In some more 'advanced' economies, leasing (not purchasing) equipment may be an option, and, as part of leasing arrangements, responsibility for security can potentially be transferred (at least in part) to the company that actually owns the equipment.

The growing trend in many education systems towards 'bring your own device' (or 'BYOD', sometimes this is referred to as 'BYOT', with 'technology' substituting for 'device) policies and approaches, where students and/or teachers bring their own ICT equipment to schools and use it, instead of using equipment provided by the school itself, can dramatically change the security dynamic when it comes to preventing the theft of such devices. If you own the device yourself, you may be much more incentivized to make sure that it is not stolen than if it belong to the school or education system! (BYOD policies don't necessarily lead to less theft in all circumstances, of course. In some circumstances, someone may be more willing to steal a tablet from another student than from the school itself.)

The difference between stealing a computing device that is being used in a school setting, as opposed to a computer that belongs to a school, may seem a semantic and legalistic distinction of little practical relevance, but it can be a compelling one to certain groups within educational bureaucracies. (The most important thing for teachers and students is that the equipment is there, not who owns it!) That said, it
can be useful to note that who owns a particular device can impact whether or not it is stolen -- and who cares.

10. Educate your users and personnel
There are many additional measures that can be utilized to help prevent the theft of ICT equipment from schools that can be boiled down to one word: education. Training of IT personnel, school administrators and teachers -- and students too! - - about theft prevention and general related 'good practices' can help a lot. Posting signs supporting such messages can be useful. Including items related to security as part of standard 'acceptable use policies' is a good idea. (Standard in many education systems, AUPs serve as informal contracts of sorts, laying out rules for students, parents and teachers that must be agreed to in order to utilize ICT equipment).

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Many other things can be done to help to prevent the theft of ICT equipment in schools, of course. All such measures carry with them various costs -- of money, accessibility, and usability. Schools and education systems have to consider important related trade-offs between prevention, policing, and accessibility. Given enough time and energy and smarts, dedicated thieves can probably find their way around all of these (and other) anti-theft measures. As with approaches to security in general, a multi-layered approach is typically best. A combination of measures, big and small, involving a variety of different people, incentivized in different ways to be part of the process, can help where any one single approach is insufficient.

You may also be interested in the following posts from the EduTech blog:
- Re-thinking School Architecture in the Age of ICT
- School computer labs: A bad idea?
- When students are in charge of maintaining the computers in schools

Note: The image at the top of this blog post ("if you don't pay attention, I'll steal this tablet right out of your pocket!") comes from the Project Gutenberg archives via Wikimedia Commons. The image used at the end of this post of the locked gates at Harvard Yard is courtesy of Occupy harvard also via Wikimedia Commons. Both are in the public domain. The second image (of a locked door at the Tajjar Building in Pakistan provided by the Wikipedian Soban) also comes via Wikimedia Commons and are used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license. The image of two children outside a closed door ("hey check this out, I think someone is stealing our pico projector!") was provided by Deutsche Fotothek of Germany's Saxon State Library / State and University Library Dresden (SLUB) to Wikimedia Commons as part of a cooperation project. It is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Germany license.
Complexities in utilizing free digital learning resources
by Michael Trucano
#19: originally published on Wednesday, 2 December 2015

Here’s a scenario I have encountered more than a few times.

Officials at a ministry of education in ___ tell me that:

They've bought lots of computers.
They've put computer labs in their schools.
They've connected (most of) their schools.

And:

Lots of their teachers have (inexpensive) laptops.

Now their students are getting tablets.
Along the way, they've been teaching basic computer literacy.

Which leads them to ask:

\textit{Now what should we do?}

(In my experience, this query may be a result of an evaluation that showed little or no ‘impact of technology on student learning’, despite massive amounts of money that have been invested … or it may simply come about because a lot of initiatives are coming to an end and the groups involved in them are looking for stuff to do. There are other impetuses as well, but I am regularly reminded that the motivations which animate this sort of question can vary quite a bit!)

In such instances, I usually respond by first congratulating them on all of these great accomplishments. A lot of hard work by a lot of dedicated people was needed to make these things happen, and no doubt lots of difficult challenges popped up along the way.

However:

As difficult (and expensive) as it may have been to achieve all of these things, in many ways they represent just table settings, and not the main course. In other words (and to adopt another metaphor, in case you didn't like that last one), they are some of the key raw materials that can be used to help do something purposeful with technology to supports learning that has real, demonstrable impact.
It's about the content, not the container, after all. (That will be the last metaphor for a while, I promise.) As devices proliferate, and as better and more widespread connectivity enables connections to networks from different places using a variety of different devices, the value will decreasingly be in the devices themselves, but rather in the educational content they enable learners and teachers to access (and in the connections to communities of other people as well).

OK, they counter, if the value is indeed in the content, and not the container ... where do we get this content?

The textbooks we use do not have straightforward digital equivalents or complements.

We really haven't budgeted for any digital learning content. We spent almost all of our money on hardware (and a little on related training).

We know that there is a lot of 'free' content available on the Internet that would be useful to teachers and students.

Can't we just use a bunch of this stuff?

And if so:

How might we go about doing this?

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It is no doubt true that there are lots of high quality digital learning resources available on the Internet for free use (CK12 is one of many great examples of a collection of such materials). Some of them are indeed available for free, some of them are free because they have been donated, some of them are even available as 'open educational resources' (OERs), and some of them are free because they have been pirated. (It still surprises me that I occasionally have to remind folks that it's not a very good idea to consider using educational materials that fall into this last category.)

The emergence of free, high quality digital education content has been a great thing for many schools, teachers and learners around the world (especially where English is spoken). Education systems themselves, however – especially those in so-called ‘developing countries’ -- have often struggled to take advantage of this phenomena.

While such free resources are available in increasing abundance, whether there are:

- 'free' resources that are in a country's language of instruction;
- 'free' resources that cover the topics in a country's curriculum (in the right sequence); and/or
"free' resources that are easy to map against an education system's curricular objectives can be another matter entirely.

In my experience, many ministries of education focus mostly (and often only) on the first item:

_These materials look really good, but they are only in English. All we have to do is translate them and we'll be good to go._

OK ... maybe ... but assuming that you have already vetted this content for quality, you may want to temper your ambition here about what you can reasonably expect to accomplish in the short run. This stuff may not be as easy as it may first appear:

Before you start translating materials, you should ask:

- Do you have the rights to do this?
  Just because something is available on the Internet doesn't mean you can just do with it want you want.

You should then consider:

- Do you have a process and capacity in place to do this?
  _Or: Do you know someone who does who can help you?_

- Do you have somewhere to put these materials once you have translated them all?

Just because you 'have a web site' doesn't necessarily mean you actually have a place to host this stuff easily in ways that will ensure that people will be able to find it, nor that you will be able to keep track of what you have.

Let's say you decide to translate a large body of existing 'free' digital learning resources so that they can be used in your schools (perhaps you will do this yourself, perhaps you will use content translated by some other group).

As arduous and time consuming and expensive as the translation process may be, once this has been done, you will then be faced with what is in many ways a much more vexing question:

**How are you actually going to use all of this stuff?**

As part of the process of answering this question, education systems may want to consider:

1. **Mapping** this body of digital learning resources, both in their entirety and one-by-one, against their existing curricula and curricular objectives
2. **Sequencing** individual materials in ways that are appropriate and relevant for use by teachers and students.

3. Helping teachers **orchestrate** the use of these materials for learning. Let's briefly consider each of these three actions.

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**Mapping**

Attempting to discover how well a given set of digital education materials developed elsewhere 'maps' to what you are already teaching, and what you hope student learn, can be (as the engineers like to say) 'nontrivial'.

Some countries have discovered that an attempt to do this exposes deficiencies in their own knowledge and understanding of their existing curricula and curricular objectives. In some education systems -- especially in some low income countries -- relatively few people within a ministry of education may have a good functional overview and understanding of this stuff. Instead, the related expertise may lie primarily with a publisher, or with the consultants or outside agency which helped develop the curricula.

Some questions for policymakers to ask themselves:

- Can you go through the body of digital materials, resource by resource, and map individual items against your curricular objectives -- and is there a process and tool in place for doing this?
- Can you annotate individual digital learning resources in some way, adding guidance and information ("meta data") about which curricular objectives can be addressed through the use of specific individual content (and groups of content)?
- Are there any gaps, and if so what do you intend to do about them? (Not worry about them? Create new content? Search for and adopt/adapt digital content from another source? Digitize existing off-line content?)

Depending on the answers to these (and other) questions, there are many more worth considering as well.

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**Sequencing**

When a ministry of education examines a set of 'free' digital learning content in order to assess the extent to which it maps (or doesn't map) to its existing curricula, it sometime notices that some of the sequencing is 'off':

- the order may be 'wrong'
- individual pieces of content may address multiple curricular objectives in a way not consistent with the sequencing of its own curricula
- individual pieces of content may require prior knowledge (and so are essentially 'out of order')
Along the way, it may become apparent that there are potential cultural issues with this new digital content as well, especially if it was developed somewhere else -- e.g. references to names and places that students and teachers may not recognize and/or pictures of people and places that are undeniably 'foreign' (in some places this is a nonstarter, in other cases this is not a big deal, but it is an area worth attention).

Ignoring challenges related to the sequencing of digital learning materials doesn't make them go away. Instead, this work is, as a practical matter, outsourced for teachers to figure out and handle themselves. This raises some additional issues, like: Are teachers capable of doing this themselves? Do they have the necessary skills and capacities, and tools, to do this well? Are they incentivized to do this? Do they even have the time?

In many cases I've observed, all of this is left to teachers to figure out on their own.

*The result? Little happens.* Computers sit unused. National digital learning portals are unvisited. On the rare occasion that impact evaluations are done, little impact (of 'computers', of digital learning resources) on student learning is found. A small cohort of 'super teachers' may be successful, of course, but these are the exceptions that prove the rule. Calibrating a country's approach to the utilization of digital learning resources across its entire education system based on experience with a small cohort of teachers at the far end of the Bell Curve may be a recipe for disappointment. **What will work for the majority of teachers?** That may be a more useful target cohort to consider.

Where there are challenges related to sequencing, it may be decided to create new content, either from scratch, or by breaking existing content into smaller pieces so that it aligns better with the sequencing of the existing curricula. Who will do this?

*a common response:*

Can't teachers take care of all of this themselves? Can't they just find the content they need, evaluate it, and decide how/where it fits into their needs? And where there are gaps, can't they just create their own materials? After all, they know what they are supposed to be teaching, their own classroom context, the needs of their students, etc.

Maybe. **It depends:**

Are they indeed able to do this (do they have sufficient skills and experience)?
Are they motivated (and possibly explicitly incentivized) to do this?

And, at a practical level:

Do they have the time to do this?

In education systems characterized by massive teacher shortages, and low capacity teachers, related challenges may be particularly acute. In such environments, most teachers are not content developers themselves, nor are they experts at evaluating the suitability of content. That said: Of course some teachers may well be very good developers of digital learning resources -- or can be trained to become so. Excellent teachers do this regularly around the world, and many countries have had teachers do this in an official capacity (e.g. Rio, Jordan).

It is perhaps worth noting that having teachers create digital education materials for use by other teachers may (sometimes, or even often) yield content that is, frankly, not that good. The World Bank has supported numerous efforts to train teachers to create digital learning content in places as diverse as Uganda, Nicaragua and Ghana, and the results have been decidedly mixed. Even where the content is, for lack of a more technical term, 'not terribly good', however, creating content themselves, and evaluating content developed by their peers, can be a very useful professional development exercise for teachers. Once a teacher has created her own digital materials, especially learning content to be shared with and used by her peers, she tends to be better equipped to analyze and evaluate content herself, no matter who provides it. She is a more 'educated consumer', if you will.

In many countries, these sorts of challenges around mapping and sequencing are often rather important. In my experience, few ministries of education with which I have worked have appreciated the size, scope and nature of these challenges before jumping in. (There is nothing like learning-by-doing, I guess!)

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Orchestrating

Let's say a large body of 'free' digital learning materials has been mapped against existing curricular objectives and made available and accessible in schools in sequences that make sense. What assistance and support is available to teachers as they attempt to orchestrate the use of the content as part of their teaching and their students' learning? The dirty little secret of many large scale efforts to utilize free digital learning materials at scale across an education system is that very few
people may end up using them. A few great teachers and students may use them a lot, of course, but most may do so rarely, if at all.

This need not be the case, however! Education systems can employ a number of strategies to try to avoid this sort of calamity. One standard approach is to offer targeted teacher professional development and training in how to use these materials. This is usually quite necessary but at the same time not sufficient. One-off training activities in special training centers may indeed be helpful, but such environments may not be good proxies for the teaching and learning environments teachers will find themselves in once they return to their schools. Considering examples and use cases which take into account specific circumstances in local classroom environments can therefore be rather important. Providing opportunities for formal or informal 'coaching' as content is rolled out can also be useful, as can various sorts of related ongoing training activities. Offering user-friendly supplementary usage guidance (online, offline, and/or embedded in the digital learning materials themselves) is also strongly worth considering. One of the most useful approaches (but one which is often not considered, in my experience, or at least not often enough) is to help support and maintain peer networks so that teachers can communicate with and support each other. (If teachers are connected, why not take advantage of this connectivity?)

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All this seems like a lot, you might say.

We asked you a simple question and you have responded by asking lots of other questions for which we don't have answers and raising ideas and challenges we hadn't considered.

We thought we could just take a bunch of digital content we found on the Internet and we'd be good to go.

--> It rarely is that easy.

You might say: This seems like there is a lot to do. This might well be true, especially given your existing capabilities and budget.

But, on the other hand:

Can you afford not to do this -- or at least not to start?

After all:

You already bought all of this equipment for your schools -- what do you plan to do with it?

(There's another big issue about aligning this with your assessments ... but that's a topic for another day ...)
It is worth noting that textbook publishers have traditionally handled a lot of these things in many places. In other places the ministry of education, or a special unit or agency under the direction of the ministry has done so (sometimes with the help of various types of technical assistance from publishers). The increased availability of 'free' digital learning resources on the Internet has led to a *misunderstanding* on the part of many policymakers, who conclude that there is no little or no value in what content creators and publishers (whether private companies, public institutions, nonprofits or civil society groups) do in providing a coherent body of learning resources in ways that are relevant to given curricula, sequenced in ways that align with these curricula, and where it is clear how to 'orchestrate' the use of this content as part of regular teaching and learning practices. Creators of educational content -- whether they are 'traditional publishers' or new developers of educational videogames -- have as a result noted that it's **tough to compete with free**. But just as the fact that some things are available for free doesn't mean they have no value, *'free' doesn't necessarily mean that there are no related costs*. There is a difference between having a coherent whole and a collection of high quality parts, no matter how high their individual quality.

Of course, the educational publishing industry itself is evolving, and related business models are evolving rapidly as well. Many new players (e.g. for profit tech companies, non-profit providers of open education resources) are entering the market space, and the old ones are changing -- because of market forces, because of new technologies, and because of new phenomena (like open educational resources) that the diffusion of new technologies enables. This complexity and change doesn't make the jobs of policymakers and educators any easier, I'm afraid, even if at the same time there are lots of exciting, useful, high quality 'free' digital learning materials increasingly available to teachers and students. **But who said this stuff was easy?**

You may also be interested in these posts from the EduTech blog:

- Textbooks of the future: Will you be buying a product ... or a service?
- Mapping Open Educational Resources Around The World
- Calculating the costs of digital textbook initiatives in Africa
- Translating and implementing the Khan Academy in Brazil

*Note: The image at the top of this post of a cat helping herself to some free material ("What do you mean, 'gratis' or 'libre'? It's 'free' and so I'm taking it!") comes via Wikimedia Commons and is in the public domain. The picture of the two curious racoons at the Rotterdam Zoo ("what a minute: where's the content?") comes via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 2.0 Generic license. It was originally posted to Flickr by photographer Tim Strater. The third image, of a rather large dog ("I thought I would be done once I got over the paywall") comes from the Wikipedian Pat028 via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution-Share Alike 3.0 Unported license.*
This week over a million students around the world will participate in the Hour of Code, an annual event designed to excite interest in computer science and computer programming. This reflects a growing interest in some quarters to promote efforts within schools to broaden awareness of what it means to 'code' (i.e. write a set of step-by-step directions that instruct computers to do something) and to help students develop related skills.

Perhaps not surprisingly, many leading technology firms have been keen proponents and supporters of this educational coding 'movement'. While such support has been particularly pronounced and high profile in the United States -- many of the prominent organizations have close ties to and/or roots in Silicon Valley -- this is long past being only a North American phenomenon.

Citing the increasing importance of coding skills, and IT jobs more broadly, to their national economies, policymakers in many countries are considering national coding education efforts of various sorts -- and a few education systems have already begun to implement related initiatives. From Trinidad and Tobago to Indonesia to Nigeria, 'coding' is being introduced into classrooms and curricula around the world in various ways, both informally and (increasingly) formally as well, for better and/or for worse (depending on your perspective, and the particular nature or rigor of the specific initiatives).

This phenomenon is notably observable across Europe, where, rather famously (at least within the communities of people who care about and pay attention to such things), Estonia and the United Kingdom have introduced coding curricula for students beginning in early primary grades (the UK has actually made this mandatory – as has Slovakia, for what that’s worth). Each year in October, CodeWeek.eu serves as a continental focal point and showcase for many of these sorts of national and regional efforts. A recent report from the European Schoolnet (Computer programming and coding - Priorities, school curricula and initiatives across Europe [pdf]) features results from a survey of 21 ministries of education about their current coding-related initiatives and plans for the future. To date, 16 European countries have integrated coding into their curricula at some level (with Finland and the Flemish part of Belgium expected to do so in 2016). While the focus of most of these countries has been at the upper secondary level, coding is increasingly to be found (or soon to be found) at the primary level at a majority of
these countries as well. The report highlights a number of important related pedagogical questions that are emerging out of European experience:

- How to design effectively the learning processes and outcomes involving coding?
- Which concrete activities (and programming languages) are most appropriate for different students, according to their age, interests and capacities?
- What are the particular merits (and limits) of adopting a cross-curricular approach to teaching coding or a discrete computer science subject?
- How to refine assessment, in particular where coding is integrated in a cross-curricular approach in other subjects?

It also highlights many challenges related to training and support for teachers. While many of the startups developing the tools and services that make the coding movement possible are in the United States, Europe is in many the ways at the center of actual related activities in schools.

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“Coding”, it is said by some, is the “new literacy”. The ability to write and understand computer code, some contend, is increasingly fundamental to understanding how to navigate one’s way through, to say nothing of succeeding in, a modern society where more and more of our lives are enabled and/or constrained by the actions of devices and information systems that run on computer code.

Few would argue with the notion, I would expect, that efforts to expose some students to ‘coding’, and to develop some related skills, is a bad thing. That said:

**Should *all* students learn how to code?**

*All? That’s ridiculous!* some would answer.

*All? Absolutely!* others respond.

I’ve sat in on a number of related discussions in ministries of education and at education policy forums around the world. At times, it can seem like members of these two groups are not only on different pages, but reading from totally different books. **Those people just don’t get it**, I’ve have heard representatives from both groups lament about each other after the conclusion of such meetings.

For what it’s worth, and in case it might be of any interest to others, here are, in no particular order, some of the most common arguments I hear made both in support of, and against, educational coding initiatives:

1. **Coding education will help students acquire vocational skills that are immediately relevant to today’s job market.**

   Look at all of the IT-related jobs available in the world, coding education advocates say. *Shouldn’t our schools be specifically preparing our students to compete for them?* Setting aside larger questions about the proper place of vocationally-oriented classes and approaches within an education system (some folks have a bit more expanded view of what ‘education’ should mean than something that is only
meant to prepare the workers of tomorrow) and agreeing that some perspectives are a bit extreme ("Latest Craze for Chinese Parents: Preschool Coding Classes"), critics respond that many related efforts are a waste of time in practice for a number of reasons. These include that: (a) they focus on developing largely mechanical processes that are easily learned in other venues; (b) they are largely concerned with “job-relevant” skills of today, not tomorrow; (c) initiatives of this sort are largely driven by the business sector (a group whose motives they view with great suspicion); and (d) many current efforts have little pedagogical value in and of themselves. Often cited with particular disdain are projects purportedly about coding but which amount to little more than learning how to use basic office tools such as word processors and presentation software. Proponents counter that arguing that something shouldn’t be done in the future because it is often done badly today doesn’t always make for a winning argument, and that just because the private sector supports a particular activity in schools doesn’t necessarily mean it is bad or that nefarious intentions are at play. Don’t throw out the baby with the bathwater, they respond.

2. Coding helps develop important logic and problem-solving skills.
Steve Jobs remarked that “coding teaches you how to think”. Few would argue against the notion that, when taught well, education in coding can help develop important logical thinking and problem-solving skills. Indeed, most coding education is at its very heart about logic and meant to be oriented to help people identify and solve specific problems (whether they are as basic as “have a greeting appear on the screen” or “move this turtle up and to the left” or as complex as trying model projected rainfall patterns or the transmission of a virus throughout a population). In response, critics argue that coding courses have no monopoly on the development of such skills, and that in fact such skills should be embedded throughout an entire curriculum, not the focus of a single school subject.

3. Understanding coding helps students better understand the nature of the world around them, and how and why increasing parts of it function as they do.
Computers play increasingly large roles in our lives, and so it’s important to understand how they function. There tends, I find, to be general agreement about this statement among education policymakers, although different groups nevertheless disagree on its practical relevance, given many competing priorities. That said, it is perhaps worth noting that many critics of educational coding efforts may perhaps not fully grasp the potential import of this observation. Computers don’t have minds of their own (at least not yet, anyway!), they act only according to the instructions that have been programmed into them. The price you are charged in the market, why your government or a private company thinks you might do (or not do) something, why a search result appears on your screen – such things are increasingly not directly determined by the whim or a person, but rather by an algorithm (or combination of algorithms) that someone has created. Understanding what such algorithms enable, and how, will increasingly be important to understand our increasingly digitized world. (Technology is neither good nor bad, Melvin Kranzberg noted, nor is it neutral.) Those who acknowledge the potentially profound insights that might follow from such observations may still
argue that there is a very practical and immediate opportunity cost here: *If you add coding to the mandatory curriculum for all students, what comes out?* Some places are considering doing things like letting coding courses be used to meet foreign language or basic mathematics requirements – is this a good thing?

4. **Teaching students to code can serve as a gateway to subsequent study of STEM topics -- and hopefully to jobs and careers in related fields.**

Reasonable people can disagree about the exact nature and magnitude of the 'STEM challenge' (i.e. problems that arise because insufficient numbers of students are studying science, technology, engineering and mathematics ... a topic for another blog post, perhaps). That said, even where critics concede that such a challenge exists, they may ask: Is 'coding' really this really the 'best' gateway to boost general interest in STEM? If coding is not well taught, might it in fact dissuade some students from further study of STEM topics, and thus decrease the likelihood that they pursue STEM-related careers? Is coding education in schools indeed a gateway to coding, or is it in practice just 'edutainment', something to do with all the computers that schools have purchased and still haven't figured out how to use productively -- better than nothing, to be sure, but not better than many potential alternatives?

*Often related to this:*

5. **Introducing coding in schools can be a force for greater equity and equality of opportunity.**

There can be little doubt that the tech industry suffers from a real problem related to diversity (or, more accurately, a lack of diversity). Efforts to introduce coding in schools in some places are seen as a measure that can help with this. Advocates maintain that, when coding is something that everyone does, it is no longer something just e.g. for boys, or for kids with computers at home, or for people in California or India, or who are Caucasian or Asian or ____ [feel free to insert your own stereotype and/or ‘privileged’ group]. Providing more exposure to coding for a wider variety of kids can certainly help to some extent, critics might counter, by helping to providing some initial opportunities for those who may not otherwise get them and by chipping away at some stereotypes, but the situation is rather complex, and much more needs to be done. Such critics worry that, because there are coding initiatives in schools, certain leaders will declare that the diversity challenge is being ‘solved’, or at least ‘handled’, and leave it at that. Supporting international efforts like Girls Who Code or more localized programs like GirlsCoding (in Nigeria) is all well and good, such critics say, and certainly a good start, but it isn’t ‘solving’ the problem.

6. **Being able to code enables new avenues for creativity and creative expression.**

Efforts to teach coding skills to young students through the use of tools like Scratch, or as part of robotics courses or initiatives to promote ”making” (and/or “physical computing”), are often cited as compelling examples of what (good) coding education efforts may comprise. Here again, many critics may laud such efforts but still argue that, even if you concede that coding is a new literacy in our
increasingly technology-saturated world, it is still worth asking two rather basic questions before moving ahead with new, large-scale, mandatory educational coding initiatives in schools:

How are we doing with the old, basic literacies of reading, writing and arithmetic?

Shouldn’t we ensure that these fundamental “literacy skills” are in place before we start tacking new ones on to our already bloated curricula?

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Some related discussion:

Where a great teacher is working with and supporting an eager, motivated student as she learns to code, many find it hard to argue against doing (more of) this sort of thing. Educational “success”, after all, is at a basic level largely a function of tapping into a learner’s inherent curiosity (and not stifling it!). If we are talking about a situation where a dis- or slightly interested learner is made to learn and practice by rote a number of rather basic commands and actions related to “how to make a computer do something”, especially by a teacher who herself does not know the subject well and where that “something” largely relates to how to do things like change font sizes in PowerPoint -- well, that is something that perhaps no one should have to learn in school as part of the official curriculum. There is of course space in between these two extremes where things get a little more interesting, and complicated.

When considering that broad middle area, a quote from artificial intelligence pioneer Roger Schank might be useful. Schank (provocatively, as is his wont) declares that, "Any cognitive scientist worth his salt knows that it isn’t subjects like algebra or chemistry that matter. It is cognitive abilities that are important." The same holds, it can be argued, when it comes to coding. It might be that coding itself is not really the goal (although of course we do need coders, just like we need chemists) – but if wide-scale coding education helps students develop their own cognitive abilities, then it is a potentially useful means to a larger end.

As an extracurricular or enrichment activity in education systems that are already doing a good job in promoting the development of basic literacy skills, the introduction of efforts to promote coding in schools may, according to such lines of thinking, seem rather reasonable, especially where such efforts help engage or energize otherwise disinterested learners -- particularly where such students may not, for reasons of bias, discrimination or stereotyping, be considered (or even consider themselves) as candidates to learn such things. In places where there are still great struggles to help students develop basic literacy skills, however, especially in many
middle and low-income countries, it should not be surprising if many policymakers consider educational coding efforts to be, as one such official recently put it to me, a “luxury” that they “cannot afford right now”.

That said, policymakers in some such places are beginning to change their tune. Faced with a recognition that the basic ‘computer literacy’ classes which (for better or for worse) monopolized the use of computing facilities in their schools in the past may be no longer needed (because students or already ‘computer literate’), or are ‘ineffective’ (because such courses haven’t demonstrated real value), or are simply out-of-date (technologies change so fast!), some of these people are now asking themselves: *What do we do with all of the expensive computing equipment we have installed in our schools if we are no longer teaching ICT literacy?* In such circumstances, calls to introduce classes in ‘coding’ can fall on particularly fertile soil, for better or for worse, as policymakers look to fill seats in existing school computer labs while exhibiting what might charitably be termed a ‘crisis of imagination’: *Computer Class 1.0 was ‘ICT literacy’, but that’s over, so now we’ve moved on to Computer Class 2.0: ‘Coding’, because that’s the latest thing to do. (We know this because it was in a TEDtalk.)*

There is another way to consider the potential value and relevance of ‘coding’ education in schools, however -- although to be honest this viewpoint remains a distinct outlier in related discussions of education policymakers in which I have participated. According to this line of thinking, the real value in ‘coding’ education is not that this will develop market-relevant computing skills and lead (at some point in the future) to an increase in the number of computer programmers. (This may occur, and if it does, that’d of course be great, but that isn’t the real aim, proponents say). Rather, coding courses can be used to help students develop skills so that they can ‘think algorithmically’ and engage in so-called ‘computational thinking’. According to folks at Carnegie Mellon, which is a hotbed of related activity, “Computational thinking is a way of solving problems, designing systems, and understanding human behavior that draws on concepts fundamental to computer science ... [It] means creating and making use of different levels of abstraction, to understand and solve problems more effectively. Computational thinking means thinking algorithmically and with the ability to apply mathematical concepts such as induction to develop more efficient, fair, and secure solutions.” According to such folks, ‘learning to code’ is really about developing skills, approaches and familiarity with tools that help enable the use of ‘coding to learn’. ‘Coding’ isn’t something just for programmers and computer scientists, in other words, but of relevance to *all* learners, and is potentially relevant to *all* subjects taught in school.

That said, even where such arguments find a receptive audience with policymakers (and I find that, for the most part, they have not), one common challenge across all education systems is that there is a shortage of teachers who themselves can teach and integrate related basic concepts and approaches into their subjects so that students can develop and utilize coding skills while learning about ‘traditional’ topics taught in schools: not just science and math, but also history, language and even subjects such as art or physical education (yeah, even that’s possible – but it takes
a rather special gym teacher, in a rather special school environment). Given this practical reality, the impulse to introduce separate coding classes with dedicated coding teachers has an obvious allure. Let’s first teach kids to code, and to think algorithmically, and once we’ve got a good start with that we’ll try to figure out how to make this stuff relevant to how they spend the other hours of their school day. Other places say: We can’t find such teachers locally, so we won’t teach this stuff at all.

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Should we teach coding in schools? What does ‘coding’ mean in our context? Who should teach it, and who should learn it – a certain few, or everyone? Can we afford to do this do? (Conversely, given that our neighbors and competitors are doing this, can we afford not to do this?) Are we interested in making sure more kids ‘learn to code’ and then stop there, or is it more about developing the skills that would help students eventually ‘code to learn’?

Whatever the situation or context, how a policymaker answers these and many of other related questions is probably colored quite a bit by how she views the role and process of education, and the activity of learning, more broadly.

You may also be interested in the following posts from the EduTech blog:

- How (not) to develop ICT literacy in students?
- When students are in charge of maintaining the computers in schools
- Ten things about computer use in schools that you don’t want to hear (but I’ll say them anyway)
- Educational technology and innovation at the edges
- Education & Technology in Africa: Creating Takers ... or Makers?
- A ‘mobile first’ approach to educational technology

Parts of this post originally appeared in a slightly different format on the WISE ed.review site as part of an essay with the title, Should All Students Learn How to Code? Pros and Cons. This was one in a collection of short essays exploring related issues; other contributions came from Audrey Watters, Mitch Resnick and Jack Lawicki.

Note: The image used at the top of this post of earth ("hello world!") comes via Wikimedia Commons and is in the public domain. (If you recognize it, it's probably because it was the first ever image of earth taken by humans, as part of the Apoloo 8 mission.) The second image of a boy in a shopping cart ("is there room for some coding in there?") was originally posted to Flickr by garycycles. It was discovered via Wikimedia Commons and is used according to the terms of its Creative Commons Attribution 2.0 Generic (CC BY 2.0) license.
The introduction of large scale computer adaptive testing in Georgia
by Michael Trucano
#21: originally published on Wednesday, 16 December 2015

Testing: For better and/or for worse, many education systems are built around it (although some perhaps not as much as others). In numerous countries, a long-standing joke asks whether 'MOE' stands for 'Ministry of Education', or 'Ministry of Examination'? (This joke is not meant to be funny, of course.)

'Testing' is a source of and trigger for controversies of all different sorts, in different places around the world. The word 'standardized' is considered negative by many people when it is used to modify 'testing', but it is perhaps worth noting that a lack of 'standardized' tests can have important implications for equity. Within the U.S., the Obama administration recently declared that students should spend no more than 2% of classroom instruction time taking tests. However one feels about the wisdom of setting such hard targets (one could argue, for instance, that it's not 'testing' per se that's the problem, to the extent that it is indeed a problem, but rather 'bad testing') and the various types of time accounting shenanigans that might predictably emerge so that the letter but not the spirit of such declarations are met (a school could be creative about what it feels constitutes a 'test' or 'instruction time', for example), there is no denying the centrality of testing to approaches to education in schools around the world.

'Testing' means different things to different people. There are important distinctions between assessments that are formative (i.e. low stakes means to provide feedback to teachers and students on how much students are learning, as a way to identify strengths and weaknesses and act accordingly) and those that are summative (e.g. high stakes final exams).

It's also potentially worth noting that tests can be utilized not only as means of assessment, but explicitly as tools to help learning we well (an approach sometimes called 'studying by testing'; here's an interesting related paper: When Does Testing Enhance Retention? A Distribution-Based Interpretation of Retrieval as a Memory Modifier [pdf]).

The point here is not to get into a debate about testing, as illuminating and energetic (or frustrating and political) as such a debate might be. Rather, it is to shine a light on some related things happening at the frontier of activities and experiences in this area that are comparatively little known in most of the world but
The nature of tests and testing is changing, enabled in large part by new technologies. (Side note: One way to predict where there are going to be large upcoming public sector procurement activities to provide computing equipment and connectivity to schools is to identify places where big reforms around standardized testing are underway.) While there continues to be growing interest (and hype, and discussion, and confusion) surrounding the potential for technology to enable more 'personalized learning', less remarked on in many quarters is the potential rise in more personalized testing.

The science fiction author William Gibson has famously observed that, *The future is already here, it's just not evenly distributed.* When it comes to educational technology use around the world, there are lots of interesting 'innovations at the edges' that are happening far away from the spots where one might reflexively look (like Seoul, Silicon Valley or Shanghai, to cite just a few examples that begin with the letter 'S') to learn practical lessons about what might be coming next, and how this may come to pass.

When it comes to testing, one such place is ... Georgia. This is not the Georgia in the southern United States (capital = Atlanta, where people play football while wearing helmets), but rather the small, mountainous country that borders the Black Sea which emerged as a result of the breakup of the Soviet Union (capital = Tbilisi, where people play football with their feet).

**Georgia is the first country in the world to utilize computer adaptive testing for all of its school leaving examinations.**

What does this mean, what does it look like in practice, what is there to learn from this experience, and why should we care?

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Perhaps not surprisingly, given that the institution employs literally thousands of economists, currently provides over US$14bn in financing for education systems around the world, and is an enthusiastic advocate for more data driven decisionmaking, the World Bank devotes a great deal of time and energy into documenting activities and supporting research into topics related to educational assessments [pdf].
As an input into discussions in Armenia, where they have been considering the potential adoption of computer-adapted testing, the World Bank commissioned a background paper and case study of lessons from recent efforts in Georgia to introduce CAT-based school leaving examinations. The result -- *The Introduction of Large-scale Computer Adaptive Testing in Georgia: Political Context, capacity building, implementation and lessons learned* [pdf] -- is a clear, lucid and step-by-step dissection and analysis of the Georgian experience. Its author, Dr. Steven Bakker, stopped by the World Bank recently to talk about the experiences in Georgia, together with senior officials from Georgia's Ministry of Education and its National Assessments and Examination Center (NAEC).

Bakker framed his discussion by asking (and then attempting to answer) the following question:

> Why has it taken so long to introduce on-line assessments as part of large-scale, high-stakes exams in countries with long-standing examination traditions, such as the United Kingdom, the Netherlands and the United States, and why could it be introduced in Georgia almost overnight?

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Sometimes, being first to something means that you will be late to whatever comes next. In international development circles, there is much talk of the potential for 'leapfrogging' as a result of the introduction of new technologies in some places, in comparison to other places which have to deal with legacies and inertial pulls of various sorts related to 'older' ones. While such 'leapfrogging' is often celebrated and seen as inevitably 'good', *it is of course possible to leapfrog in the wrong direction.*

To help make sure that the Armenians were orienting themselves as well as they could during their considerations of the potential applicability of computer-adaptive testing within their education system, Bakker explored lessons from various aspects of the Georgian experience, both in his paper and during the course of a fascinating presentation. These include: the political context; the human and material resources that were needed; the process of capacity building; how stakeholders were informed; the implementation of CAT in schools; costs; the impact it had on all involved and on the educational system in Georgia; and the limitations of CAT and its current implementation of Georgia, and possible ways forward. The German military leader Carl von Clausewitz is meant to have remarked that 'amateurs talk strategy, professionals talk logistics and implementation.' The context for von Clausewitz was war, of course, something slightly different than our context here, but in this regard Bakker's discussion was that of the 'professional'.

As with so many things, context is key, and there are many 'special' circumstances which may have led to this sort of innovation first being roll out at scale in Georgia, and not some other country. First, the country itself is small, with a population of under four million people and a land size about that of Sri Lanka or Ireland (and half the size of the U.S. state with the same name). This small size meant that a 'big bang' approach to introducing CAT for school leaving exams was feasible: It
was possible (although of course not always easy, especially in rural areas) to implement in every school, all at once. In 2008, the first cohort of students to complete 12 years of compulsory education graduated (before this time, only 11 years had been required), but the school leaving exams (which were administered by the schools themselves) were rather easy and, as a result, many grade 12 students were skipping school to work with private tutors to prepare for their university entrance examinations. Introducing standard national school-leaving exams, it was hoped, would help bring many of these students back into school for their final year.

In addition, Georgia has had a number of initiatives to introduce computers and the Internet in schools, and so a basic level of both technical infrastructure and comfort level were in place (both within the education system, and across broader Georgian society) which could serve as a foundation for the introduction of something like 'computer-adaptive testing'.

Georgia had another thing going for it that many countries (especially countries of its comparatively small size and level of economic development) do not: a local population that includes technical experts with strong psychometric, mathematical and technological skills who could plan for, implement and evaluate a technically complicated initiative such as CAT.

CAT, sometimes referred to as 'tailored' testing, is a type of computer-based testing that adapts to the ability level of the person taking the test. In basic terms: If you get a question correct, you get a more difficult question. If you get a question wrong, you get an easier question. Complex computer algorithms work to adapt the difficulty level of the test questions to better match the ability level of the test-taker, reducing e.g. the number of 'easy' questions that high ability test takers are shown, as well as the number of 'hard' questions that 'lower ability' test takers are shown (being shown more questions to which you don't know the answer increases the likelihood of guessing; getting a question 'correct' because you guessed doesn't actually demonstrate that you answered that question correctly). Potential benefits of CAT include a reduction in cheating (because test takers are shown different questions) and in time sitting for an exam (because test takers don't have to 'waste' time trying to answer too many questions which are either much too difficult or much too easy). This all sounds great in theory, but in practice doing something like this, and doing it well, is rather nontrivial.

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*is that a bug or a feature?*
So: What exactly happened in Georgia?

As one account [pdf] of this initiative relates,

"In Georgia the Ministry of Education and Science decided in September 2010 to use computer adaptive testing (CAT) as the delivery mode for the re-introduced external school graduation exams and to conduct the first administration in May 2011. International experts were quite sceptical about the feasibility of a nation-wide rollout of such a logistically and technologically complex measurement instrument as a large scale CAT at such short notice. In May 2011, 44,000 students sat eight computer adaptive subject tests in one of the 1500 test centres established in Georgian schools."

This was the consequence of a short but technically rigorous consideration of a number of key questions, including:

- Is it sufficiently known if CAT delivery in a computerized testing center will indeed be more secure than paper and pencil test in a local gym?
- Will converting the [school leaving] test to CAT likely bring the expected reduction in test length?
- Does the [anticipated] reduction in test length translate to enough saved examinee seat time – which can be costly – to translate into actual monetary savings?
- Even if CAT costs more and does not substantially decrease seat time, are these disadvantages sufficiently offset by the increase in precision and security to make it worthwhile for the organization?
- Does the organization have the psychometric expertise, or is it able to afford it if an external consultant is used?
- Does the organization [NAEC] have the capacity to develop extensive [question] item banks?
- Is an affordable CAT delivery engine available for use, or does the organization have the resources to develop its own?

For a discussion of how these (and many other related) questions were answered in Georgia, both conceptually and at a practical implementation level, have a look at Bakker’s paper. It's quite good. You’ll find clear details about lots of things, including: computer hardware and connectivity; some nitty-gritty related to the actual test itself; the institutional structures, people and skills necessary to pull something like this off; the information and advocacy campaigns that have been integral to the roll-out; and some mundane, practical details about how the test is actually administered. Countries who wish to learn even more about all of this may be interested to know that, during most years, Georgia hosts an international conference to share lessons from its efforts in this area, as well as to learn from related developments in other parts of the world.
For what it's worth, here are a few things that I took away from the presentation and follow on question-and-answer session with Bakker and representatives from the ministry of education and the National Assessments and Examination Center (NAEC), as well as with World Bank colleagues who know a *lot* about assessments in general, complementing what I learned from reading the paper (I took copious notes and hopefully I understood things correctly; if/where I did not, this was undoubtedly a consequence of my own cognitive and note-taking limitations, and not the ability of many experts and practitioners who patiently and kindly tried to explain things to me):

**Costs**

How much does it cost to do something like this? *It is difficult to say.* The paper makes an attempt to identify and quantify certain costs. That said, it is worth noting (as the Georgians do, based on their experience) that many costs are not immediately apparent and/or are absorbed in other ways. There are costs to create and maintain the question bank, but they would be doing much of this anyway. There are costs related to test administration. There are costs related to computers -- although, it should be noted, schools in Georgia already have lots of computers. There are new and substantial costs related to the surveillance cameras, and the storage of the related data. But by far the largest expense relates to training, certifying and paying the 2300 test proctors who are on-site in schools.

**Designing for technology constraints**

The CAT, and the infrastructure to support it, were explicitly designed to work within the existing technology constraints. This was an important design consideration (and, it is worth noting, usually a rather good practice). One result: Every single keystroke a student makes while taking a test is buffered (saved), so that, if there is a problem, nothing is lost, and students can re-start from exactly where they were before, should there be any glitches.

**Testing in advance of the test**

Each year they hold a full scale mock online test for all 45,000 students in all 1600 testing centres about one month before the official testing commences. This has been important for a number of reasons. Perhaps most importantly, this test has meant that students, teachers, proctors, schools officials and representatives from
other stakeholder groups could actually see and experience the testing environments personally, which helped to dispel many related myths and worries. As part of this effort, students take a practice test on the computers. (That said, there are challenges related to student motivations in this regard: it can be difficult for students to take a practice test like this seriously if their scores don’t count, which means that the scenario isn’t a perfect proxy for what happens on actual test days). A large scale, synchronous test of this sort at school testing centres across the country is also a very good test for the robustness and reliability of the technology infrastructure which makes online testing of this sort possible.

**Connectivity and bandwidth**

Rolling out a national program for mandatory, synchronous online testing presented an interesting connectivity challenge in Georgia: How do you ensure adequate bandwidth at schools for the test takers? For a few weeks each year, the ministry of education needs absolutely reliable, very fast and secure broadband supporting lots of concurrent users for a few hours each day, available to *all* schools in all regions of our country. It is critically important that not only all schools have access to a common minimum level of bandwidth, but that some schools do not have access to bandwidth that exceed the defined minimum acceptable levels to the extent that this provides test takers in those schools with various advantages. ISPs in many countries, especially small ones, don’t typically get clients with these sorts of demands, and MOEs aren’t used to negotiating for (or even spec’ing out) what they need in this regard. This means that there are new actors on both the supply and demand sides of the connectivity equation, both of which are exploring new products and services, for which competitive local markets do not (yet) exist. This makes the process of tendering rather ... challenging.

In Georgia there are currently around 1600 testing centres in use in schools. 570 of these schools had fibre connections to the Internet, the rest of the schools did not, and so these less (and in some cases un-) connected schools needed to be connected wirelessly in order to meet the minimum connectivity requirements to function as test centres. (Local wi-fi networks have been benchmarked to ensure that they are able to handle 30 concurrent students; each of whom needs 30kbps continuously for the testing application to work.) The Internet provider in Georgia has been able to provide a wireless CDMA/EVDO connection (i.e. not the standard 3G connection normally available to wireless customers in Georgia) to each school test centre. This has meant that testing centres could be installed in schools in the mountains, resulting in less stress for students who otherwise would have had to travel from their home villages to other schools in order to take part in the tests. (In some rural communities, because wireless traffic to/from schools takes precedence on the related mobile networks, during the time of testing it can be more difficult for people in the village to get a mobile signal.)

**Cheating and security**

A number of actions have been taken to try to prevent cheating, as well as to detect it as quickly as possible, where it might nonetheless occur. Most notably, and expensively, and intrusively, 1800 surveillance cameras were purchased and installed in schools. Within each school testing centre, empty seats were placed
between each student, to make it difficult for them to whisper to each other or pass notes. (Computers were placed on the desktops in front of these empty seats, so that if a computer went down, a student could just slide over to an adjacent seat and continue with very little delay.) Monitoring software was installed on the computers, and certain basic functionality (e.g. screen shots, printing) was disabled. Internet access was also disabled except for access to the testing web site itself. A special shell or user interface ensured that test takers could only see the test on the screen, they couldn't access any other applications or windows. USB ports were also closed, disabled or removed. No mobile phones were allowed in the test centres.

(I asked if they had considered measures what have been implemented in some places in China, where drones hover above schools where tests are occurring in order to block attempts to communicate with test takers who have smuggled in phones; they had not considered this, but were intrigued that this was being done!)

These measures have meant that there has been very little apparent cheating or 'leakage' of test questions -- at least so far. It is possible for students to memorize the questions as they appear on the screen and then later share them on the Internet, but the testing authorities monitor for this in various ways, including mentions on social media (a practice that, it is worth noting, has generated controversy in other parts of the world). To date, this reportedly hasn't been a problem (or if it has been a problem, the authorities haven't discovered it yet). The bank of test questions itself has apparently not been compromised either. (That said, there was no test in 2013, when the head of the assessments centre was dismissed. When he and his team was re-instated, there were concerns about whether the integrity of the test bank had been compromised, so an all new question bank had to be created.)

No attempts to take down the networks utilized for testing or the testing servers have yet been detected; I assume that such things are unfortunately not a matter of if, but when. (They don't -- yet -- do penetration testing, i.e. explicitly hire groups to try to hack the system in some way, sit at a testing centre and cheat, etc., but that might be something that will come with time.)

Transparency and openness
In the minds of many policymakers, there are important tradeoffs consider related to security and transparency. Where stakeholders are not able to see the individual items after the test has been completed and scored, trust is key. For a number of reasons, and as a result of numerous related actions, gaining the trust of key stakeholder groups in Georgia has been achievable. Some related questions potentially worth asking when considering the potential relevance of the Georgian experience to other countries: Do citizens trust their government with this stuff, given that it is very difficult to have such things independently audited? If the test questions are kept secret, and the algorithms at the heart of CAT remain proprietary and/or unpublished -- as has been the case in Georgia -- what measures to promote transparency and trust might be useful to consider?
Some related idle speculation:
It would potentially be possible to have the surveillance cameras installed to help prevent cheating in school test centres monitored remotely in real time ... perhaps in a call centre in another country, or even in a 'crowd-sourced' way by the general public over the Internet. My point in speculating about this isn't to suggest that such things are good ideas, rather to note that such things are becoming technically possible. Inevitably, someone will eventually propose to do such types of things, and so policymakers may wish to anticipate and start thinking about how they might feel about such proposals.

User buy-in
Soliciting and listening to feedback from a number of key stakeholders groups has been very important to this whole effort in Georgia. According to the paper, "The need for a well-planned and coordinated information campaign was seriously underestimated by the Ministry of Education, which resulted in a variety of rumors and fears of massive percentages of students failing and punitive measures being taken against under-achieving schools. Eventually, NAEC, using its image as a reliable institution and its good relations with schools, managed to convince the educational community that the test results would not be used against them, but would support them in achieving their goals."

School principals have generally been supportive of the move to CAT. They especially like that they receive feedback as a result of CAT that they didn't get before (e.g. about how their school compares to others, to see how students did on individual test item categories, etc.). That said, principals haven't liked that they couldn't see individual test questions, which makes it difficult to appeal, should someone wish to contest their score. (Students see the test questions on screen, but once they go to the next screen, they can't go back.) Generally speaking, teachers remark that CAT appears to be fair, but note that this is just one of many means of possibly assessing student performance. They especially like that CAT hasn't been used for 'accountability' purposes (i.e. to punish teachers or principals if students don't perform well enough). There is regret, but both teachers and students, that students can't change their answers once they have been entered. (On this point: Psychometricians respond that, in CAT, if you make a mistake, it doesn't really matter that you can't correct it -- at least psychometrically, realizing that you have made a mistake but are unable to correct it can impact test takers in other ways -- because basically you 'correct' things as you answer future questions to arrive in the end at your appropriate "level".) Upon completing a test, students immediately learn whether they have passed or not. Some students (and their parents) have complained that, under CAT, some students can finish the test in only 15 minutes (because they were either very high or very low scorers and so their level could be determined relatively quickly) while it took other students 45 minutes to complete a test.

The advantage and disadvantages of keeping your expertise in-house
At the NAEC, the Georgian Ministry of education has 'in-house' expertise that can plan for, manage and evaluate the entire CAT implementation process. This arrangement creates an environment supportive of iteration (constant, regular
improvement over time) and ensures continuity over time, to things that might not be supported to the same extent if the entire process were to be contracted out to e.g. a private company. There are risks associated with concentrating all of this sort of expertise within a single institution, however. (Marveling at what the Georgians have done, I wondered about the potential for a company to be spun off to commercialize what has been done and sell the resulting products and services to other countries.)

Unintended consequences
The implementation of new technologies almost always bring with them unintended, and unforeseen, consequences. One example from Georgia: Like in many other countries, the Ministry of Education is keen to see a decrease in private tutoring (which some might argue is, in certain ways, an indirect privatization of education). Bringing students back to school to prepare for the school leaving exam means that they don't use this time to skip school to spend that time with their private tutor for university entrance exams. Some students, however, respond that now they feel the need to go to tutors for *both* the school leaving and the university entrance exams, meaning that there is an overall increase in private tutoring (although whether this is actually the case or not is still to be determined).

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Taken together, lessons from the experience of Georgia to introduce computer-adaptive testing for all of its school leaving exams underscore that, in the end, success or failure when it comes to introducing new technologies in education is not really a result of the technology itself. The technology is important, of course -- *indeed it is critical, and it can be difficult to 'gets thing right', especially the first time around* -- but making all of the right technology decisions does not necessarily mean that an initiative will be successful as a result. In the end it is about the ability and capacity of key actors within an education system to plan for, manage, absorb and implement change. It is through this lens of *change management* that the successes and challenges of CAT in Georgia should perhaps best be considered. **There is certainly much that can be learned in this regard from Georgia's pioneering example.**

You may also be interested in the following posts from the EduTech blog:
- Assessing education with computers in Georgia
- Crowdsourcing, collaborative learning or cheating?

Note: The image used at the top of this post of an empty examination room ("We feel so lonely now that everyone has moved over to the computer room") comes from [Wikimedia Commons](https://commons.wikimedia.org) and is in the public domain. The picture of the broken pencil ("broken?") comes from the Wikipedian Pwlps via [Wikimedia Commons](https://commons.wikimedia.org) and is used according to the terms of its [Creative Commons Attribution-Share Alike 4.0 International license](http://creativecommons.org/licenses/by-sa/4.0/). The picture of a Luprops beetle on a pencil in Kerala ("is that a bug or a feature?") is from [Mathews Sunny Kunnelpurayidom](https://commons.wikimedia.org) via [Wikimedia Commons](https://commons.wikimedia.org) and is used according to the terms of its [Creative Commons Attribution-Share Alike 3.0 Unported license](http://creativecommons.org/licenses/by-sa/3.0/). The final image, of a mountain peak near Ushguli, Georgia, was originally posted to [Flickr](https://www.flickr.com) by [Ilan Molcho](https://www.flickr.com). It was discovered via
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about the author

Michael Trucano
Sr. Education & Technology Policy Specialist
Global Lead for Innovation in Education
The World Bank

Michael Trucano is the World Bank's Senior Education & Technology Policy Specialist and Global Lead for Innovation in Education, serving as the organization's focal point on issues at the intersection of technology use and education in middle- and low-income countries and emerging markets around the world.

At a practical working level, Mike provides policy advice, research and technical assistance to governments seeking to utilize new information and communication technologies (ICTs) in their education systems. Over the past 18 years, Mike has been advisor on, evaluator of, and/or working-level participant in, educational technology initiatives in over 45 middle- and low-income countries.

Current and recent areas of notable activity and attention include: ICT/education policy development; the development of national agencies leading educational technology initiatives; new directions in educational publishing and digital learning resources; the use of mobile devices (especially mobile phones) in education; online learning (including MOOCs) and assessment; developing standards for globally comparable data related to technology use in education; technology use to support teaching and teachers; assessing the impact of technology use in education; 'new economy skills'; child Internet safety; and low-cost 'ICT devices', especially those used in rural and poor communities.

A frequent public speaker and interview subject on the use of technology in education around the world, and on ICT use for development (ICT4D) purposes more broadly, he is the principal voice behind the World Bank's influential EduTech blog.

On the research side, Mike leads the World Bank's related analytical work under its flagship Systems Approach for Better Education Results (SABER) initiative as it relates to information and communication technologies (SABER-ICT).

As part of his official duties, he leads the World Bank's global solutions group on 'innovation in education', which helps to maintain the organization's internal knowledgebase on related topics, provides technical support and guidance to country projects, and sponsors numerous knowledge-sharing events each year.

In addition to his advisory work on projects funded by the World Bank and other international aid agencies and donors, he serves on a number of external advisory boards for non-profit groups and prize committees and organizes off-the-record efforts to help groups learn from 'failed' projects and initiatives.
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