Harnessing OER to Drive Systemic Educational Change in Secondary Schooling

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Introduction

In the world of education, there has been a growing buzz about the concept of Open Educational Resources (OER) and how it can transform education around the world. Since being coined at a UNESCO Conference in 2002, OER has been the subject of increased attention globally, with many donor-funded projects (most often, led by universities) providing space to experiment with different models of openness and research the educational effect that these might have. More recently, governments and inter-governmental organizations around the world have begun to examine the educational potential of OER and open licensing more closely.

Two studies conducted in 2012 provided clear evidence of this growing interest. First, a survey on OER Policies conducted by the Commonwealth of Learning (COL)[1] collected several examples of government policies on OER and open licensing. More importantly, though, research on the business case for OER[2] provided clear evidence of growth in OER activities extending beyond the realm of funded projects, with governments particularly showing an interest in the economic potential of using open textbooks to reduce the cost of procuring materials for schooling. That research concluded that:

> *There are at least four areas in which emerging data demonstrates actual or potential economic gains to be had from harnessing OER. These are:*
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> 1. *Harnessing OER in the creation of new, contextually relevant courses. [A] case study from Guyana demonstrates powerfully, if only anecdotally, the significant cost reductions that this approach can yield.*
> 2. *Applying open licences in the textbook market. The economics of the textbook market, especially in places where economies of scale are readily applied, indicate clearly that significant efficiency gains can be attained by shifting to open licences. This approach is accompanied by clear evidence from around the world that governments are increasingly understanding its potential and starting to shift decisively towards such models.*
> 3. *Releasing research under open licences. Although not OER per se, research is a critical resource requirement for effective education, particularly at the higher education level. Although there is still some debate about the merits of open access approaches, data is emerging that demonstrates the economic value to be gained from supporting open access models.*
> 4. *Harnessing OER to create alternative accreditation pricing models. This work is still in its infancy, and thus there is no concrete data to demonstrate actual economic gains, but it will be interesting to monitor progress in this area over the next few years.*

On the face of it, these trends hold great potential, especially in developing countries, where finances are generally scarce and openly licensed resources offer the possibility of providing cheaper access to high quality educational and research materials for use in schools.

Increasingly, though, as governments explore the potential of OER and consider policy positions supportive of open licensing, they are doing so in ways that may not be leveraging the full transformative potential of OER. In particular, in the growth of open textbooks there appears to be, particularly in public school systems, a replication of models of education that are no longer meeting the needs of our societies. It is true that open textbooks may help to drive down the cost of delivering textbooks to schools, but they are still largely predicated on an assumption that the underlying curriculum (with knowledge organized according to very traditional subject areas), classroom-based organizational models, and roles and responsibilities defined for teachers are what will best prepare young people for their subsequent entry into society and further education.

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[1] Hoosen, S. (2012). Survey on Governments' Open Educational Resources (OER) Policies. Commonwealth of Learning and UNESCO. Retrieved from http://www.col.org/resources/publications/Pages/detail.aspx?PID=408

[2] Butcher, N., and Hoosen, S. (2012). Exploring the Business Case for Open Educational Resources. Commonwealth of Learning. Retrieved from http://www.col.org/resources/publications/Pages/detail.aspx?PID=421.

These activities are gradually having the effect of reducing the cost of educational content, as has been the case with digitized content in many other economic sectors. One may justifiably argue that this is a positive, democratizing development, which will serve to make education cheaper and more accessible in developing countries. While these developments have some positive dimensions and introduce possibilities for cost savings, there are two primary concerns. First, the emergence of 'free' and open content may increasingly be moving education systems towards proprietary content platforms that increasingly seek to lock educational systems and business models into monopolistic technologies in the hands of private companies. There is growing evidence that private companies such as Apple, Pearson, and the Notesmaster Portal are seeking to build cloud-based services that create just this kind of vendor lock-in (where content is apparently 'free' but the only route to access it is through these proprietary, cloud-based platforms) – and this may well reverse some of the economic gains of OER in the long run.

Second, it appears that these new models are now predominantly old educational 'wine' in new skins: that we are primarily harnessing the innovation of OER only to reproduce content-heavy, top-down models of education that were developed hundreds of years ago to meet the needs of societies in the aftermath of the industrial revolution, models in which the student is still primarily a passive 'consumer' of prescribed educational content whose main task is to complete standardized assessment tasks in order to receive accreditation. These educational models – still so dominant in most countries around the world – no longer meet the needs of society or meaningfully prepare our youth for the complex, information-driven world in which they find themselves.

While it is true that many schools are making dramatic and very constructive shifts in the way they operate and organize the time use and tasks of students, these changes tend to occur in either private schools or schools that operate with some degree of autonomy from government educational policies (such as charter schools in the USA). Simultaneously, based largely on a principle of picking 'low hanging fruits', the OER community is placing even greater emphasis on the development and circulation of open textbooks, largely in acknowledgement of the 'reality' that public systems change – driven by new educational policies – is too complex to achieve. The further OER moves down this pathway, the more it becomes coopted by the education system and the more blunted becomes its potential for serious systemic transformation of the dominant pedagogy of schooling.

Thus, the urgent imperative – and the real transformational potential of OER – is to evolve new systems of education that can help our societies, and especially our youth, to navigate their way through a world in which the disruption wreaked by information and communication technologies requires a completely new approach to knowledge, skills, and competence. Ubiquitous access to open content offers an opportunity to re-think the basis on which we organize the educational experiences of school students and to liberate the time of teachers so that they can focus on providing meaningful support to students rather than continuing to act predominantly as conduits of information from the textbook to the students.

In doing this, there is an opportunity to overhaul resource use and the nature of teacher-student interaction so that students can develop key attributes required for success in the knowledge society, including higher order thinking skills, lifelong learning habits, and the ability to think critically, communicate, and collaborate, as well as to access, evaluate, and synthesize information. If OER simply replicate the models of the past, though, a great opportunity will have been lost to usher in these critically needed systemic changes. However, for this change to be effective and equitable, it needs to be driven by government policy changes, as these ultimately dictate the operations of most public schooling systems. Given that most OER proponents consider such systematic changes to be largely out of reach, it is now essential for the OER movement to be able to demonstrate this kind of educational transformation at a systemic level, rather than within individual schools.

Before exploring possible systemic or policy responses to these challenges, it is worth analysing in more depth what the changing imperatives are and how these might affect schooling.

Evolving Educational Needs in Changing Societies

Similar to all other spheres of society, the nature and demands of the workplace have been influenced by the accelerating pace of change related to globalization, technological advances, and knowledge that has grown into a commodity to be traded for economic prosperity. Shifting demographic patterns, the rapid pace of technological change, and economic globalization are considered dominant impacting factors that now significantly influence the future of work.[3] In some countries (particularly in the developed world), employers face an additional challenge that, despite a growing global population, they will soon have to recruit from a shrinking workforce due to an aging population. Ernst and Young recently revealed global labour force participation rates and determined a projected growth in the global population from 6.9 billion in 2010 to 7.6 billion in 2020, while the working-age population is declining, and expected to continue its downwards trend in many countries.[4]

In addition to shifting demographic patterns, economic globalization affects industries and segments of the workforce that were historically relatively insulated from trade-related competition. Trade in services grows faster than trade in goods – and the trend is set to continue.[5] The pace of technological change is generating advances in human resources, production processes, and the nature of products and services. Consequently, a different kind of 'skill' is increasingly needed in the workplace. Trade in services has grown from 18 to 30 percent of the total over the last 20 years, while some higher-skilled, white-collar jobs in the services sector, such as ICT and business processing services, are increasingly outsourced.[6]

The aforementioned factors, among many other influences, increasingly contribute to changing work patterns. Organizational theorists summarize the impact on the world of work as follows:[7]
- Increasing pressures on organizations to be more competitive, agile, and customer-focused.
- Communication and information technology breakthroughs have increased the need for the workforce to be able to adapt to changing technologies and shifting product demand.
- Shifts in the nature of business organizations and the growing importance of knowledge-based work also favour strong non-routine, cognitive skills, such as abstract reasoning, problem-solving, communication, and collaboration.[8]

'Work' in its traditional form is a concept that originated from the industrial age, and it supports the notion of 'going to work', meaning an employee arrives at a specific location, for a specific time to carry out specific predetermined tasks. Managers worked from the philosophy of managing by seeing,

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[3] No author. Workforce for the Future - Preparing the Workforce for the Future. Retrieved from http://www.mwdh2o.com/BlueRibbon/pdfs/Workforce-Future.pdf
[4] Ernst & Young (no date). Six global trends shaping the business world-Demographic shifts transform the global workforce. Retrieved from http://www.ey.com/GL/en/Issues/Business-environment/Six-global-trends-shaping-the-business-world---Demographic-shifts-transform-the-global-workforce
[5] Jiabao, L. (2014). Services trade growth outpaces that of goods. China Daily USA. Retrieved from http://usa.chinadaily.com.cn/business/2014-01/10/content_17228518.htm
[6] RAND Corporation. (2004). The Future at Work — Trends and Implications. Retrieved from http://www.rand.org/pubs/research_briefs/RB5070/index1.html
[7] Heerwagen, J., Kelly, K., and Kampschroer, K. (2010). The Changing Nature of Organizations, Work, and Workplace. Retrieved from http://www.wbdg.org/resources/chngorgwork.php
[8] RAND Corporation. (2004). The Future at Work — Trends and Implications. Retrieved from http://www.rand.org/pubs/research_briefs/RB5070/index1.html

and they valued employees as implementers of work, not as instigators of ideas.[9] Over the last 30 years, though, ICT has changed the world of work in more than one way. While technology advances productivity, making jobs faster, more accurate and easier, it is also reducing the demand for many types of human workers. Some industries have practically ceased to exist, some have had to change and adapt to take on board new technology, and some new industries have developed.

Anecdotal evidence from the MIT Digital Review illustrates ways in which technologies are threatening jobs:

• Robots and advanced automation have been common in many types of manufacturing for decades. In the United States and China, the world's manufacturing powerhouses, fewer people work in manufacturing today than in 1997, thanks at least in part to automation.

• Modern automotive plants, many of which were transformed by industrial robotics in the 1980s, routinely use machines that autonomously weld and paint body parts—tasks that were once handled by humans.

• A less dramatic change, but one with a potentially far larger impact on employment, is taking place in clerical work and professional services. Technologies like the Web, artificial intelligence, big data, and improved analytics—all made possible by the ever increasing availability of cheap computing power and storage capacity—are automating many routine tasks. Countless traditional white-collar jobs, such as many in the post office and in customer service, have disappeared.[10]

These changes in the organization of work and the tasks that employees have to carry out are likely to have greatly influenced the composition of the firms' workforces and their demand for labour and skills. We have seen the disappearance of the 'job for life', the emergence of the knowledge economy and loss of many unskilled and semi-skilled jobs to technological changes.[11] A direct consequence of advanced used of technology in the workplace is a drastic decrease in the demand for technical skills and manual labour. There is a growing mismatch between the skills that employers need and the talent available. An estimated 31% of employers worldwide find it difficult to fill positions because of talent shortages in their markets, according to the 2010 Talent Shortage Survey from Manpower, an international employment agency.[12]

At its most basic level, technology is and always has been about making people more efficient. For example, many farmers now use Global Positioning System (GPS) enabled tractors and automated irrigation systems to optimize farming crops, replacing the jobs of people who traditionally performed manual tasks.[13] Other locations that are experiencing a radical drop in the need for manual labour and semi-skilled workers include mining, factories, and other production or processing related institutions. Technical change is increasingly taking the form of 'capital that effectively substitutes for labour'.[14] A 2013 paper by Carl Benedikt Frey and Michael Osborne argued that jobs are at high risk of being

[9] Lee, A. (2012). Workplace Transformation and the Changing Nature of Work. Organisation Solutions. Retrieved from http://www.organisationsolutions.com/Resources/Strategy-Execution/Workplace-Transformation-and-the-Changing-Nature-of-Work#sthash.EiRIeaE0.dpuf

[10] Rotman, D. (2013). How Technology Is Destroying Jobs. MIT Technology Review. Retrieved from http://www.technologyreview.com/featuredstory/515926/how-technology-is-destroying-jobs/

[11] National Careers Council. (2013). An Aspirational Nation: Creating a culture change in careers provision . Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/205147/bis-13-919-national-careers-council-report-an-aspirational-nation-creating-a-culture-change-in-careers-provison.pdf

[12] Ernst & Young (no date). Six global trends shaping the business world-Demographic shifts transform the global workforce. Retrieved from http://www.ey.com/GL/en/Issues/Business-environment/Six-global-trends-shaping-the-business-world---Demographic-shifts-transform-the-global-workforce

[13] Fately, B. (2011). Will There be a Market for Manual Labor? What low-tech positions will still exist in another 10, 20 or 30 years? Industry Week. Retrieved from http://www.industryweek.com/workforce/will-there-be-market-manual-labor

[14] The Economist. (2014). The future of jobs- The onrushing wave. Retrieved from http://www.economist.com/news/briefing/21594264-previous-technological-innovation-has-always-delivered-more-long-run-employment-not-less

automated in 47% of the occupational categories into which work is customarily sorted.[15] These include accountancy, legal work, technical writing, and several other white-collar occupations.

Since the capabilities of machines and technology in the workplace have advanced, semi-skilled and skilled workers have found themselves facing increased competition for jobs. Advances in technology have resulted in mechanized manufacturing and agricultural processes. Such processes have steadily and relentlessly squeezed labour out of the manufacturing sector in most rich economies. For example:

> *The share of American employment in manufacturing has declined sharply since the 1950s, from almost 30% to less than 10%. At the same time, jobs in services soared, from less than 50% of employment to almost 70%. It was inevitable, therefore, that firms would start to apply the same experimentation and reorganisation to service industries.[16]*

A study by the Australian Department of Broadband, Communications, and Digital Economy[17] found that, in the manufacturing industry environment, the key ways in which ICT can increase productivity are through its capacity to reduce costs, increase the capability of machinery, and provide increased flexibility in production planning and scheduling. This research also confirmed that ICT allows for increased scale and speed of machinery operations, as well as an expanded management span of control/coordination. Increased capability comes about through the digital control hardware embedded in the machinery and the process execution systems that monitor and control factory operations. Additional productivity and performance enhancements may accrue to those companies that successfully integrate process control systems with corporate systems through software solutions such as manufacturing execution systems (MES):

> *Detailed discussions with managers indicated that, in the factory environment, the impact of ICT on labour productivity can be dramatic as a result of its capacity to fully automate production processes and systems. Automated production and processing systems holds huge economic benefits as companies require fewer employees while increasing production in shorter periods of time.*

Until recently, it has been assumed that job growth will be in the information economy, while the demand for manual labour and skilled-workers will decrease. However, an increasing number of technology analysts believe that recent developments in computing may mean that some white-collar jobs are more vulnerable to technological change than those of manual workers. The following examples illustrate this problem:
• Share trader – an increasing number of trades in financial markets are carried out automatically by computers, accounting for more than 70% of volume of the New York Stock Exchange in 2013.
• IT administrator – software developed by the company IPSoft, and used by firms such as ING Direct and Morgan Stanley, has managed to reduce the workload of their IT departments by up to 90%.
• Librarian – many academic and public libraries are starting to trial the use of e-books, instead of hard copies. The increasing use of self-service machines for loans, and renewals, radio-frequency identification (RFID) tags for books and the ubiquity of Google and Wikipedia, are also reducing the demand for traditional librarians. A recent survey showed most libraries were using RFID to cut costs rather than improve service.

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[15] Frey, C.B. and Osborne, M.A. (2013). The Future Of Employment: How Susceptible Are Jobs To Computerisation? Retrieved from http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf
[16] The Economist. (2014). The future of jobs- The onrushing wave. Retrieved from http://www.economist.com/news/briefing/21594264-previous-technological-innovation-has-always-delivered-more-long-run-employment-not-less
[17] Australian Government Department of Broadband, Communications and Digital Economy. (2013). 3.1 The contribution of ICT to productivity. Retrieved from http://www.archive.dbcde.gov.au/2009/february/ict_in_australian_manufacturing/digital_factories_the_hidden_revolutio n_in_australian_manufacturing/3_ict_productivity_and_business_performance/3.1_the_contribution_of_ict_to_productiv ity

- Legal researcher – American and British law firms are using sophisticated search software to cut down the time needed to scrutinize documents in certain types of cases.
- Military pilot – Increased use of unmanned drones (UAVs), instead of manned aircraft, is set to reduce the need for pilots in the Royal Airforce. Some police forces in Britain and America are investigating the use of UAVs as a cheaper alternative to helicopters in surveillance operations.
- Journalists have experienced increasing demands for electronic media. Documentary maker Tom Streithorst, who has reported on conflicts from Colombia to Libya, believes the shift from print to the web means 'what used to get you a decent paying job now just gets you a minor celebrity in the blogosphere'.
- Many established music and publishing retailers have struggled to adapt to the challenges posed by the rise of e-commerce. The American bookstore chain Borders recently filed for bankruptcy, citing competition from online retailers and e-books, prompting congressman Jesse Jackson Jr to claim the iPad – which he himself uses – 'is now probably responsible for eliminating thousands of jobs'. He also demanded to know, 'what becomes of publishing companies and publishing company jobs?'[18]

As a consequence of these trends, according to the International Labour Organization's (ILO's) Global Employment Trends, unemployment increased, leaving an accumulated total of some 197 million people without a job in 2012. Moreover, some 39 million people have dropped out of the labour market as job prospects proved unattainable, opening a 67 million global jobs gap since 2007. A quarter of the increase of 4 million in global unemployment in 2012 was in the advanced economies, while three quarters was in other regions, with marked effects in East Asia, South Asia, and Sub-Saharan Africa. Those regions that have managed to prevent a further increase in unemployment often have experienced a worsening in job quality, as vulnerable employment and the number of workers living below or very near the poverty line increased. These staggering unemployment rates are worsened by the fact that young people remain particularly stricken by the crisis. Currently, some 73.8 million young people are unemployed globally and the slowdown in economic activity was projected to push another half million into unemployment by 2014. The youth unemployment rate – which had already increased to 12.6 per cent in 2012 – is expected to increase to 12.9 per cent by 2017. [19]

The claim that lingering unemployment is not cyclical but 'structural' is now regularly cited in the media and amongst policy makers. This suggests that growth in unemployment rates is not due to a lack of demand for workers, but rather due to employers who cannot find the skills, knowledge, and competencies to match the employer's needs.[20] Today's young people and adults face tough competition for jobs, yet many employers report difficulties in recruiting people with the right skills. The consequences of efficient technological advances on the workplace are clear – fewer semi-skilled or unskilled people are needed as technology 'replaces' the work of people in factories, mining industries, and agricultural operations, to name a few. The subsequent question is not how to re-create jobs for unskilled, semi-skilled and manual labourers, but to ensure that education systems do not produce graduates who are only good for unskilled, semi-skilled, and manual labour?

[18] Partridge, M. (2011). Computer says, you're fired: how technology dictates the way we work. The Guardian. Retrieved from http://www.theguardian.com/money/2011/may/14/computer-technology-changing-work

[19] International Labour Organization (2013). Global Employment Trends 2013 - Recovering from a second jobs dip. International Labour Office, Geneva. Retrieved from http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_202326.pdf

[20] Mishel, L. (2011). Education is Not the Cure for High Unemployment or for Income Inequality. Economic Policy Institute. Retrieved from
http://www.epi.org/publication/education_is_not_the_cure_for_high_unemployment_or_for_income_inequality/

The ILO recently revealed that all signs point towards persistent high unemployment rates and fewer skilled people entering the world of work.[21] School-to-work transition surveys of developing countries show that youth are far more likely to land low quality jobs in the informal economy than jobs paying decent wages and offering benefits. The ILO sketches a bleak scenario for future employment and raises a number of questions for education and training institutions, researchers and policy-makers.

Considering the Skills Required

In a fascinating review of *How Computerized Work and Globalization Shape Human Skill Demands* American professors Frank Levy and Richard Murnane explored how growing use of ICT is changing the American workforce by automating certain tasks and facilitating the offshoring of others. Amongst other topics, the document focused on distinguishing between problems that have rules-based solutions, which can therefore be computerized and automated, and those that do not and therefore require human creativity to be solved. Importantly, it also concluded that a key emerging competence is the ability to identify appropriate rules-based solutions (or combination of solutions) to apply to specific problems, again a uniquely human competence.[22]

In conducting this review, the paper concluded that education systems need to place increased emphasis on key basic and advanced skills if they are to produce skilled people to meet changing economic demands. Because this neatly summarizes some of the key competences that will be required of people given the changing employment trends described in the previous section, excerpts are quoted at some length below:

Basic Skills

> *The ability to read becomes particularly important in economic disequilibria when people must process new information to learn new routines. In these disequilibria, society relies on text to disseminate information rapidly. As computer technology and increased global competition accelerate the rate of economic change…the need for reading has increased correspondingly.*

> *The faster pace of change has also increased demands for writing. For example, a growing number of firms ask employees to document solutions to new problems so the solutions can be disseminated throughout the organization. The documentation can only be effective if it can be clearly understood. The reliance on email to exchange information rapidly similarly requires the ability to write clearly and persuasively.*

> *Because of computerization, the use of abstract models now permeates many jobs and has turned many people into mathematics consumers…in most cases, a computerized tool does the actual calculation, but using the model without understanding the math leaves one vulnerable to potentially serious misjudgments.*

Teaching Advanced Skills

> *Begin with Expert Thinking – the ability to solve problems that, unlike algebra, lack explicit rules-based solutions. These problems must be solved through some form of pattern*

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[21] International Labour Organization. Global Employment Trends for Youth 2013. Retrieved from http://www.ilo.org/global/research/global-reports/global-employment-trends/youth/2013/lang--en/index.htm

[22] Levy, F. & Murname, R. J. (2005). How Computerized Work and Globalization Shape Human Skill Demands. MIT IPC Working Paper IPC-05-006. Retrieved from http://mercury.ethz.ch/serviceengine/Files/ISN/29255/ipublicationdocument_singledocument/251462a2-e5cc-4e6a-838c-467b0d834e09/en/2005-006.pdf

recognition. Rules-based solutions must still be part of a curriculum – i.e. students still need to know subjects like algebra. But a curriculum must recognize that a rules-based solution is usually the second part of a two-part problem solving process. The first part of the process – the part that retains labor market value - is the ability to recognize which rules-based solution applies in a particular case…Understanding consists of seeing a pattern. Learning this kind of pattern recognition takes practice. In particular, it requires going beyond traditional assignments where a student knows that the problems at the end of a chapter on long division can all be solved using long division – no need to think about which rules apply. In subjects like history or literature, the equivalent of rules-based solutions is a focus on narrow facts – e.g. dates and names and little more. In this case, going beyond rules-based solutions means teaching the underlying relationships among narrow facts.

The skill of Complex Communication – making effective oral and written arguments, eliciting information from others – can similarly be taught using existing subject matter. But teaching this skill requires both a change in emphasis and additional time - the time needed to review and grade oral presentations and frequent student essays.

Perhaps the biggest potential obstacle to increasing students' mastery of Expert Thinking and Complex Communication are…tests (assessments) that emphasize recall of facts rather than these critical skills.[23]

The Importance of Creativity

Linked to the above, however, is another key attribute, urgently required but not often actively fostered in education system: creativity. Above all else, solutions to economic challenges, particularly in developing countries, will lie in creative thinking. Without this, we will never define appropriate niche roles for national economies, or develop innovative solutions that the scale of developmental problems demand. On the one hand, this is a blessing. Other than an abundance of raw materials in many developing countries – which, as Iqbal Quadir has noted, has tended to impede rather than support development – the only meaningful untapped resource is people. And yet there is often a misplaced belief that this resource will never be tapped, despite the obviously abundant richness of creativity running through the veins of all developing societies. The fundamental problem is that we do not yet see, or have not defined, meaningful social or economic value in the kinds of creativity that permeate many developing societies. And education systems unfortunately tend to exacerbate the problem. As Sir Ken Robinson, senior advisor to the J. Paul Getty Trust, notes:

Being wrong is not the same as being creative. However, what we do know is that, if you're not prepared to be wrong, you'll never come up with anything original. By the time they come to be adults, most kids have lost that capacity. They have become frightened of being wrong. And we run our companies this way, we stigmatize mistakes. And we're now running national education systems where mistakes are the worst things you can make. And the result is that we're educating people out of their creative capacities…If you think of it, the whole system of public education around the world is a protracted process of university entrance. And the consequence is that many highly talented, brilliant, creative people think they're not, because the thing they were good at school wasn't valued or was actually stigmatized.[24]

His contention is that this problem with public education systems has largely to do with how they were shaped to meet the needs of industrial societies, needs that no longer exist as ICT and the information

[23] Excerpts extracted from: Levy, F. & Murname, R. J. (2005). How Computerized Work and Globalization Shape Human Skill Demands. MIT IPC Working Paper IPC-05-006. Retrieved from http://mercury.ethz.ch/serviceengine/Files/ISN/29255/ipublicationdocument_singledocument/251462a2-e5cc-4e6a-838c-467b0d834e09/en/2005-006.pdf. pp. 18-23.

[24] Robinson, K. (2006). How Schools Kill Creativity. TED video. Recorded February, 2006 in Monterey, California. Retrieved from http://www.ted.com/talks/ken_robinson_says_schools_kill_creativity.html

economies it is spawning create changing demands of human endeavour. This problem has peculiar connotations in developing country contexts, as such systems were typically imposed on societies through colonialism, but without the widespread industrial development that justified their existence. Paradoxically, many of these systems continue to exist, largely without any meaningful adjustment to their context of operation.

In this speech, Robinson goes on to add that

> We need to radically rethink our view of intelligence. We know three things about intelligence. One, it's diverse. We think about the world in all the ways we experience it. We think visually, we think in sound, we think kinosthetically, we think in abstract terms, we think in movement. Secondly, intelligence is dynamic. If you look at the interactions of the human brain…intelligence is wonderfully interactive. The brain isn't divided into compartments. In fact creativity, which I define as the process of having original ideas that have value, more often than not comes about through the interaction of different disciplinary ways of seeing things…The third thing about intelligence is it's distinct.[25]

Education has a critical role to play in fostering creativity, encouraging learners to be willing to be wrong, and developing intelligence in all its forms. These key attributes will be an essential requirement for our future economic, political, and intellectual leaders. Most importantly, these leaders will need to exercise these creativity to harness the broader latent potential of all of the continent's people, as this is the key resource that will need to rive sustainable economic development.

ICT and the Changing Role of Educators

The requirement to develop different kinds of skills and competences has implications not only for students but for educators as well. Clearly, it can be anticipated that educators will be required to do different kinds of work in an open and technology-enhanced learning environment. These might include the following:
• They will become facilitators and managers of learning in situations where they are no longer the source of all knowledge;
• They will plan, negotiate for, and manage the integration of learning in formal institutions, in the workplace, and in communities;
• Many may spend a considerable proportion of their workloads contributing to the preparation of courseware;
• Many of them will interact with students at a distance through any one, or any combinations, of a variety of media (of which real-time face to face interaction is only one of many possibilities);
• It will be essential that educators design and administer complicated - often computer-based - record-keeping systems that keep track of learners' progress through their individual learning pathways, pathways that reflect individual variations in learning content, learning sequence, learning strategies, the learning resources, media and technologies chosen to support them, and the pace of learning;
• Increasing proportions of their work will involve them as members of teams to which they will contribute only some of the required expertise, and of which they will not necessarily be the leaders, managers, or coordinators.

This represents a major shift from the traditional model of the teacher as exclusive source of information to the teacher as one of several resources available to learners who become more active participants in the process. This is a difficult and threatening situation for teachers, most of whom are themselves products of classroom-bound education and whose professional identities are linked to the traditional

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[25] *ibid.*

image of the teacher at the front of the classroom, and in the centre of the process. The teaching function is being transformed dramatically.

How can teachers be helped to adopt these new roles? First, they should be helped to discover the benefits of this different approach to teaching. The problem is to persuade teachers to give it a try. The bigger problem is persuading the administration to allocate time and financial resources to design and develop learning programmes in a true technology-enhanced learning mode. The innovation needs to become understandable; it should be tested and tried before teachers can be expected to make a commitment, and they must be able to see and experience the new ways they are being asked to adopt. This all adds up to the need for demonstration projects in a range of educational sectors.

Traditional education and training has been based on strong demarcations between teachers and non-teachers, academics and non-academics, administrators and technical staff, teachers and librarians, and so on. The new approaches described above mean that many of these distinctions cannot logically, practically or fairly be maintained. As already indicated, educators will need to pick up administrative responsibilities associated with managing and keeping records of open learning activities. Administrators must have an understanding of educational issues, and may be called upon to give educational advice in their capacities as members of learner support teams. Resource centre staff and laboratory or workshop technicians will advise learners working independently on projects in their areas and will engage closely with educators in the selection of resources, media, and technologies required to achieve the outcomes set within educational, academic, and training contexts.

Literature on professional development in ICT integration for teachers is generally clear that teacher skills and knowledge in ICT integration are imperative if schools are to produce students with adequate digital and numeracy skills to enable them to function effectively in 21st century economies. In order for teachers to integrate technology into teaching and learning more effectively, the focus of any professional development should embody effective pedagogy for teaching and learning for any learning situation, be it technology enabled or not. Further, teacher professional development in ICT integration should not only be focused on their use of ICT for teaching learners, but needs to show them how ICT can be used to enhance other job and social functions, for example administration and communication. In this regard, the following principles can be identified as important:

- Empower teachers to develop their knowledge and skills actively and experientially, in a variety of learning environments, both individual and collaborative;
- Include a variety of learning strategies, encompassing direct instruction, discussion, drill and practice, deduction, induction, and sharing;
- Aim at higher-order thinking skills;
- Provide an authentic learning environment so that teachers engage in concrete tasks within realistic scenarios;
- Emphasize ways in which technology can facilitate and enhance teachers' professional lives;
- Encourage teachers to be mentors, tutors, and guides of the learners' learning process (rather than simple presenters of knowledge and information);
- Develop teachers' skills in learning how to learn (define learning objectives, plan and evaluate learning strategies, monitor progress, and adjust as needed);
- Promote cooperative and collaborative learning;
- Be sensitive to the culture and diversity of teachers as learners, using a multifaceted approach to respond to different learning styles, opportunities, environments and starting points; and
- Enable learning independent of time and place. [26]

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[26] Carlson, S. (2002). The missing link in educational technology: trained teachers. *TechKnowLogia*, October – December 2002, 7 – 11. Retrieved from http://www.techknowlogia.org/TKL_Articles/PDF/I18.pdf

In addition, though, Levy and Murnane painted their picture of the changing requirements of education systems against a world shaped by the emergence of ICT. It follows then that creation of these competences implies a requirement that, for learners, these skills be forged within education worlds rich with ICT tools and applications. For, if future graduates of education systems do not feel completely comfortable wielding and moulding these tools to define and create the future economies of their societies, it is hard to imagine how they will be able to keep pace with global economic developments. To achieve this, we must create educational environments that open access to ICT, rather than closing it down or limiting it. To close such access down or to limit it because of material constraints is only to limit the creative imagination of its users. And this is why the future educational institutions at all levels will need to be connected on a scale we are simply not imagining today. The emergence of Web 2.0 is the emergence of Internet users as creators, as engaged participants in communities of practice, and we have an obligation to ensure that graduates are equipped to shape, and not just be shaped by, its development. For the developing world, this is assuming growing importance, because currently the online environment – more than any economic environment that has preceded it – is being shaped by the developed world, where the available human and materials capacity exists to mobilize large bodies of volunteers who are moulding it before its economic potential has been fully understood. In the developing world, we need to act now to reverse the unintended cultural imperialism emerging online. Education systems must take the lead in this.

However, this introduces the final and most significant challenge with regard to ICT. This is because the emergence of ICT and the Internet as a social phenomenon carries as much danger as it does potential, and educators are not equipped to enable learners to cope with these challenges. So, assuming that we are able to create educational institutions where the online world is seamlessly and ubiquitously integrated with the physical campus, students will face a new set of educational challenges. And these challenges will not be teaching learners how to use the technology to learn. They are able to learn these skills themselves without much, if any, guidance. However, as they learn the skills of using ICT in education, the professional role of educators as mentors – able to impart the wisdom that only experience can provide – will grow in importance. Thus, we need to be preparing educators to provide this mentoring, instead of which most professional development programmes are obsessed with trying to teach educators to use the technology.

Below is an overview of other key ways in which educators will need to be able to mentor and guide students in this environment, in addition to those already listed above. None of these is new nor are they directly related to ICT, but the growth of ICT as a social phenomenon heightens their importance at a time when most professional development for educators is paradoxically reducing focus on them:

1. *Fostering coherence and discipline in thinking*
   As learners become exposed to ever-increasing sources of information, the potential to become distracted grows correspondingly. While access to multiple sources of information can enrich thinking, it can also debilitate it, and educators have a critical responsibility to ensure that they foster the ability of learners to be able to concentrate, to retain coherence in constructing arguments, and to be able to think with discipline (the latter being a key original purpose of undergraduate disciplinary studies). Further, the ability to integrate different disciplinary ways of thinking – which will grow in importance – should not be confused with pastiche. To be able to engage in inter-disciplinary modes of thought, learners must first have constructed basic disciplinary platforms on which to build. The distractions of ever-expanding exposure to information and media has potential to undermine construction of these platforms, so educators will need to be better prepared than ever to help learners to develop them.

2. *Navigating the ethics of a world with no apparent limits*

A feature of the online world is that it places before people a plethora of ethical dilemmas, made more complex by the apparent anonymity of the online experience. For example: pornography comprises a significant proportion of the content accessible online; MP3 and other download sites provide ready access to vast quantities of copyrighted material; the potential for disguising and stealing identities has grown significantly in the digital world; and unsubstantiated rumour and gossip can travel around the world in seconds, often with devastating consequences for individuals. People who lack an effective, structured framework for considering such ethical dilemmas and making appropriate decisions to guide their actions will find the Internet a place for potential self-destruction, very often with broader negative social consequences. Here, the key role of educators and education systems is not to deny access to these environments in the pretence that learners will therefore be 'saved' from them. Rather, it is to provide learners the competences and knowledge to be able to navigate their way through these ethical dilemmas effectively and positively, both for themselves and for the societies of which they are part.

3. *Coping with the challenges of 'unlimited' choice*
   Another reality that technological developments have made possible is to put before consumers access to an unprecedented range of choice in almost all material aspects of life. This may sound like it only has benefit, but as Barry Schwartz notes: 'All this choice has two negative effects on people. One effect, paradoxically, is that it produces paralysis rather than liberation. With so many options to choose from, people find it very difficult to choose at all... The second effect is that, even if we manage to overcome the paralysis and make a choice, we end up less satisfied with the result of the choice than we would be if we had fewer options to choose from.'[27] If we are to open access for learners to this world of ever-increasing choice, we need also to ensure that our future graduates are equipped with the skills to cope with it effectively and responsibly, to remain decisive and able to act, without succumbing to the debilitating illusion that the choices we have not taken are the better ones.

4. *Encouraging learners to become creators in the educational environment*
   We know that a flaw in much educational practice is the tendency to treat learners as recipients of knowledge, and education as a process of information transmission. In environments where learners have ubiquitous access to the Internet, a natural tension will arise, as learners will want increasingly to become active members of communities of practice, a notion well aligned with the educational theory of constructivism. A key barrier to fostering such approaches in education, however, is the strong emphasis that is still placed on protecting intellectual property. While there may be strong commercial incentives to protect certain kinds of intellectual property, the economic and educational arguments in favour of the concept in education are spurious to say the least. Releasing intellectual property for use and adaptation under emerging licensing frameworks such as the Creative Commons[28] is possibly the single most powerful way in which academics can encourage their learners to become creators in the educational environment, who derive benefit by sharing the results of their intellectual endeavours with their peers online. Deploying Web 2.0 platforms, learners can then become a powerful force in the ongoing production and shaping of knowledge systems as these unfold globally.

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[27] Barry Scwhartz. (2005). The Paradox of Choice. Recorded July 2005 in Oxford, UK. Retrieved from http://www.ted.com/index.php/talks/barry_schwartz_on_the_paradox_of_choice.html
[28] For more information, see www.creativecommons.org.

Summary

Thus, in summary, if we are serious about economic development, we need increasingly to measure schools' performance, as well as their programmes and curricula (regardless of the subjects involved), against the extent to which they foster these competences in students:
• The ability to read and write effectively;
• The ability to understand the mathematics behind abstract models;
• The ability to solve problems that lack explicit rules-based solutions;
• The skills of complex communication;
• Creative thinking capacity and the corresponding willingness to make mistakes, fostered through the development of intelligence in all of its diversity and forms;
• Coherence and discipline in thinking;
• Competences and knowledge to be able to navigate through ethical dilemmas effectively and positively;
• *S*kills to cope with increasing choice effectively and responsibly, to remain decisive and able to act, without succumbing to the debilitating illusion that the choices we have not made are the better ones; and
• The skills and competence to become creators of knowledge, combined with the aptitude to share the results of knowledge creation through online communities of practice.

Limitations of Current Schooling Systems

Counter to these developments is the desperate state in which many schools find themselves, particularly in many developing world contexts and in public schooling systems. The way in which schooling operates today is largely a product of the industrial revolution and related social developments. In the 19th century, beginning in Europe but soon spreading worldwide, it became necessary to familiarize the masses of people to large-scale emergent social realities of industrialization and nationalism. The routine of factory work required that people be taught the necessary skills and values, such as uniformity, punctuality, and efficiency, and to gain the ability to withstand long hours of repetitive labour. The industrial economy offered employment for those who succeeded in this system. With the rise of Europe as an industrial and military power, schooling came to be seen as the key to that success, so the European model of schooling was eagerly sought by those desiring industrial and symbolic power in other parts of the world, including America and Japan. It also came to be seen as mandatory by the colonial powers, namely Britain and France, who spread this system throughout their domains. By the early 20th century, a global system of modern schooling was in place and it remains largely intact to this day.[29] The evidence of this approach to schooling can be seen, for example, in the way in which students are categorized by age into grades and then groups of them are taught with batches of material. Instituting time tables and allocating a fixed time to spend in each stage of the process of assembling an educated person was done so that educators could cope with the escalating student population in the early 20th Century. This has led critics like Christenson to argue that that most schools currently operate like a value-added process (VAP) business, where students are 'herded' into a classroom at the beginning of the school year, value is added to them, and at the end of the year they are promoted to the next grade.[30] Schools were thus designed for a time when content was expensive and the global knowledge base was relatively static, and thus the primary role was to provide much content, knowing that such content would not change much during a person's lifetime.

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[29] Progler, Y. (no date). The Failures and Limitations of Modern Schooling. Retrieved from http://www.missionislam.com/homed/failuremodernschool.htm
[30] Clayton, M.C., Horn, M.B., and Johnson, C.R. (2011). Disrupting Class. How Disruptive Innovation will Change the Way the World Learns. McGraw Hill.

Additionally, successful attainment of the Millennium Goals has driven up the number of enrolments in primary schools in developing countries. As more students exit the primary sector, new demand for secondary and tertiary education has been created. However, this rising demand for student placement has not always been matched by the state's ability to service schools with both resources and human resources. Quality teaching and learning materials, suitable physical environments with water, electricity, and sanitation, and sufficient competent staff on hand to guide the learning process are amongst the resources commonly reported as lacking by schools.

The reality is that, in many developing countries, the demand for teachers is such that many new teachers must learn on the job. Without proper pre-service training, they emulate the way they were taught. Teacher education and qualifications might follow where legislation forces them to study, but mostly these teachers learn from the environment in which they work. For example, in South Africa, there are criticisms that teachers do not have good content knowledge of the subjects they are sometimes teaching.[31] Even in contexts where pre-service teacher education is a pre-requisite traditional approaches often dominate both the training and the practice. Teachers are trained to perform in a world of monolithic, teacher-led content delivery, where the key skills are in holding students' attention to subjects.[32] Consequently teaching practice is predominantly didactic in nature, with little experimentation with alternate teaching practices that encourage problem-based, collaborative and/or project-based learning methods for example.

> *A profession whose work primarily was in tutoring students one on one was hijacked into one where some of the teacher's most important skills became keeping order and commanding attention.[33]*

The way in which teaching is conducted impacts on the learning behaviours of the students. A predominately teacher-centric approach results in students who see learning as a passive endeavour. They are rarely called to engage with the material, question assumptions, or construct their own understanding of a body of knowledge. This has been particularly exacerbated by the use of standardized testing, especially when it is used for school accountability purposes. The development of specific skills and the formation of values are often overlooked in the quest to ensure students memorise and deliver facts and content during standardised testing.

Test-based accountability has also resulted in the narrowing of the curriculum and has distorted the goals of schooling. By holding teachers accountable only for test scores (primarily in reading and mathematics), schools tend to focus less on issues such as students' health, physical education, civic knowledge, the arts, and enrichment activities. Additionally, test-based accountability overlooks what is happening during the child's life at home and in the community.[34]

Furthermore, students learn in different ways, and those who succeed in schools possibly do so because their intelligence happens to match the dominant paradigm in use in a particular classroom, or because they have somehow found ways to adapt to it. The same applies to teachers who excel in a discrete number of teaching styles and will therefore tend to teach in ways compatible with their strengths.[35]

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[31] Holborn, L. (2013). Education in South Africa: Where Did It Go Wrong? SangoNet Pulse. Retrieved from http://www.ngopulse.org/article/education-south-africa-where-did-it-go-wrong

[32] Clayton, M.C., Horn, M.B., and Johnson, C.R. (2011). Disrupting Class. How Disruptive Innovation will Change the Way the World Learns. McGraw Hill.

[33] Clayton, M.C., Horn, M.B., and Johnson, C.R. (2011). Disrupting Class. How Disruptive Innovation will Change the Way the World Learns. McGraw Hill.

[34] Abbot, J and MacTaggart, H. (2010). Overschooled but Undereducated. How the crisis in education is Jeopardising our Adolescents. London: Continuum.

[35] Clayton, M.C., Horn, M.B., and Johnson, C.R. (2011). Disrupting Class. How Disruptive Innovation will Change the Way the World Learns. McGraw Hill.

Teachers do not usually know what students have learned until a test is administered and graded, which tends to be some time after the class is completed. If students have not mastered all the material, but know it well enough to get a passing grade, the students still must move on to the next grade. And, even if they fail an examination, students usually also move on, because 'moving on' is inherent in the model of monolithic instruction. With this approach, teachers and administrators are only aware of the percentage of the students that have demonstrated mastery of what percentage of the material. The amount of time in which to learn the material is fixed, but the amount of learning varies significantly. [36]

In some instances, testing has become a central preoccupation in schools and is no longer just a measure but an end in itself.[37] The consequence of this is that learners do not learn the skills of assessing themselves and measuring their own knowledge and ability against genuine, outside challenges. It also prevents teachers from fostering creativity and encouraging connections if their constant focus is on grades.[38]

This is also seen in test preparation efforts, where, in the US for example, big contracts were awarded to companies that specialized in test-preparation activities, and schools dedicated large chunks of time to practice for the state tests. For weeks or months before the state test, children were drilled daily in test-taking skills and on questions mirroring those that are likely to appear on the state test. Once these tests were finished, there was time for other subjects, but it was difficult to maintain the same level of student motivation, because teachers and students knew the tests were the primary measures of their success or failure. In these examples, reading and mathematics were the only subjects that mattered, because they were the only subjects that counted for city, state, and federal accountability. Much of this test preparation is not designed to increase student learning but rather to try to beat or game the test,[39] and thus scores lose their meaning.

> The consequence of all this practice is that students may be able to pass the state test, yet unable to pass a test of precisely the same subject for which they did not practice. They master test-taking methods, but not the subject itself. In the new world of accountability, students' acquisition of the skills and knowledge they need for further education and for the workplace is secondary. [40]

Another challenge facing schools is that access to textbooks and quality learning materials can be limited. Families normally have to supply stationary and textbooks, items considered expensive and a burden to domestic budgets. In countries where the state supplies texts, this is an enormous expense within the education budget. Access to prescribed books and papers can also be physically difficult in remote or rural areas where distribution is problematic and expensive. This has been seen, for example, in South Africa, where that the Department of Basic Education faces challenges in distributing textbooks, which has resulted in schools not having the necessary textbooks and in some instances using outdated textbooks. Consequently, at any given time, a teacher cannot expect the entire class to have access to a particular text or set of materials. At secondary and tertiary levels, where volumes are smaller, prescribed texts can be exorbitantly expensive and students regularly sell one set of texts to purchase the next. Consequently there is a demand for quality cost effective

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[36] Clayton, M.C., Horn, M.B., and Johnson, C.R. (2011). Disrupting Class. How Disruptive Innovation will Change the Way the World Learns. McGraw Hill.

[37] Ravitch, D. (2011). The Death and Life of the Great American School System: How Testing and Choice Are Undermining Education. Basic Books

[38] Abbot, J and MacTaggart, H. (2010). Overschooled but Undereducated. How the crisis in education is Jeopardising our Adolescents. London: Continuum.

[39] Ravitch, D. (2011). The Death and Life of the Great American School System: How Testing and Choice Are Undermining Education. Basic Books

[40] Ravitch, D. (2011). The Death and Life of the Great American School System: How Testing and Choice Are Undermining Education. Basic Books

resources that can be used for teaching and learning, as well as a future reference, throughout all levels of education.

Education systems that experience all or a combination of these problems can be found everywhere, and, while common in emerging economies, can also be found in many communities within developed countries, where access to resources and sound teaching experience are problematic.

Ways of living have changed, and there is increasing priority on adaptability rather than conformity. There is also growing recognition of the need for lifelong learning to keep pace with constantly changing global job markets and technologies, as well as to increase income levels, particularly in light of recent global economic disruptions and acknowledgement that a dynamic and fast-changing knowledge-based society requires continuous skills updating.

Emergence of New Innovations in Schooling

Critiques of traditional schooling such as those presented above are not new, dating back at least to the early 1900s when Maria Montessori opened her first school where children learnt through play and self-education.[41] Montessori believed that each child is born with a unique potential to be revealed, rather than as a 'blank slate' waiting to be written upon. Montessori education is based on the belief that children have a natural desire to learn. It is a child-centred, developmentally focused approach to education, a method of observing and supporting the natural progression of children. Montessori believed that the child's education should follow the child's needs in the respective stage of her or his development rather than the teacher's curricula. This system of education is both a philosophy of child development and a rationale for guiding such growth. In a recent online post, the head teacher of a Montessori school for children from 6 to 15 years, argues for the return to the principles of Montessori education in discussion about education reform.[42]

Another alternative approach to schooling with a long history is that of the Waldorf schools, which are based on the philosophy of the Austrian philosopher, Rudolf Steiner. Waldorf education is based on Steiner's theory of child development, which seeks to promote a lifelong love of learning through incorporating intellectual, emotional, physical, and spiritual capacities. The aim is to transform schooling 'into an art that educates the whole child – the heart and the hands, as well as the head'.[43]

Several other notable educationalists and scholars have presented sustained critiques of traditional schooling. This section presents the main ideas of some key people who have been especially prominent in schooling critiques and have developed alternative approaches to education. While it is not possible to do justice to the richness of educational ideas developed by these scholars, the section below aims to highlight key features of their work in an effort to offer some thoughts regarding ways in which OER might more successfully be harnessed to support a transformative educational agenda.

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[41] Seldin, T. (2010). Dr. Montessori : A Historical Perspective. Retrieved from http://www.montessori.org/index.php?option=com_content&view=article&id=72:montessori-a-historical-perspective&catid=7:faqs&Itemid=25
Seldin, T., and Epstein, P. (2006). Dr. Montessori's Legacy. Retrieved from http://www.montessori.org/index.php?option=com_content&view=article&id=262:dr-montessoris-legacy&catid=7:faqs&Itemid=25
[42] Shawes, L.F. (2012). Montessori: The Missing Voice in the Education Reform Debate. Retrieved from http://www.huffingtonpost.com/laura-flores-shaw/montessori-education-debate_b_1237451.html
[43] Association of Waldorf Schools of North America. Waldorf Education: An Introduction. Retrieved from http://www.whywaldorfworks.org/02_W_Education/index.asp

Innovative Education Thinkers

John Dewey

Working and writing in the early 1900s, John Dewey argued against both traditional education, where the focus of schooling is on transmission of bodies of information and skills to the new generation, and progressive education, which Dewey argued tended to go too far in rejecting fixed curricula and prioritizing learner-centred education without recognizing the appropriate role of curricula and the teacher. Instead, Dewey proposed a theory of education based on students' actual learning experiences, the unity of theory and practice, and a balance of experiential learning and delivery of knowledge.[44] For Dewey, education is a social process in which the teacher should play the role of leader of group activities, rather than the authoritarian holder of knowledge. The role of the teacher is to facilitate group interaction and experiential learning.

In 1897 Dewey published his Pedagogic Creed in which he outlined many of his central principles of education.[45] Consider the following extract from Dewey's creed, which arguably remains equally descriptive of schooling in 2014 as it did in 1897.

> I believe that much of present education fails because it neglects this fundamental principle of the school as a form of community life. It conceives the school as a place where certain information is to be given, where certain lessons are to be learned, or where certain habits are to be formed. The value of these is conceived as lying largely in the remote future; the child must do these things for the sake of something else he [sic] is to do; they are mere preparation. As a result they do not become a part of the life experience of the child and so are not truly educative.[46]

Paulo Freire

The Brazilian scholar and educator, Paulo Freire, rejected the notion that education is a neutral or technical process, arguing that education should be critical, dialogical, and reflexive. This form of education, Freire argued, is part of the process of becoming more fully human. A fundamental aspect of Freire's philosophy is the notion of praxis, which refers to 'critical, dialogical reflection, and action on the world to transform it'.[47] One of the traditional educational concepts that Freire specifically argued against during the 1970s was that of 'banking education', by which he meant the educational model where it is assumed that the teacher held all the knowledge, and the teaching process was about imparting this to learners and students who did not have it.[48] Instead, Freire argued for 'problem-posing education.' Problem-posing education is based on the assumption that knowledge is not static and unchanging, and thus schooling requires students to become 'unquietly critical, challenged to understand that the world which is being presented as given is, in fact, a world made, and for this very reason can be changed, transformed, and reinvented.'[49] Other central themes in Freire's work include the importance of respecting the knowledge that learners bring with them to the classroom, the importance and value of curiosity in learning, the pedagogical significance of dialogue, good listening, conscientious decision-making, and commitment to teaching. Although

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[44] International Centre for Educators' Learning Styles. John Dewey's Philosophy of Experience and Education. Retrieved from http://www.icels-educators-for-learning.ca/index.php?option=com_content&view=article&id=53&Itemid=68

[45] Dewey, J (1897). My Pedagogic Creed. *School Journal*, vol 54, pp. 77-80. Retrieved from http://dewey.pragmatism.org/creed.htm

[46] Dewey, J (1897). My Pedagogic Creed. *School Journal*, vol 54, pp. 77-80. Retrieved from http://dewey.pragmatism.org/creed.htm

[47] Roberts, P (2000). *Education, Literacy and Humanisation. Exploring the works of Paulo Freire*, p.18. London: Bergin Garvey.

[48] Freire, P. (1972). Pedagogy of the Oppressed. New York: Continuum.
Freire, P. (1973). *Education for Critical Consciousness.* New York: Continuum.

[49] Raynolds, H. (1993). Preface, p.10. In, Freire, P., *Pedagogy of the City*. New York: Continuum.
Freire, P. (1993). *Pedagogy of the City*. New York: Continuum.

Freire's pedagogy must be understood with the social context in which he was working[50], the ideas he developed have been widely applied in developing and developed countries. In the preface to the 1993 edition of 'Pedagogy of the City', Harold Raynolds provides a helpful summary of Freire's vision for the construction of dynamic and responsive schools. In particular, he argued that a new approach to schooling should include the following:

- *Schools that respect the 'ways of being' of students*
- *Local school control of the necessary resources; autonomy and local partnership at the schoolhouse*
- *Permanent ongoing preparation for teachers based on 'reflection on practice'*
- *Transformation of schools into creativity centers where one teaches and learns with joy, ending the practices of grade retention and pushout expulsion*
- *An entirely new system of assessment appropriate to the children and their life experience*
- *A new pedagogy where students and their life experiences are the curriculum in constant interaction with teachers who can help them question and explore who they are and what has gone before.[51]*

Ivan Illich

Writing at a similar time as Freire, Ivan Illich argued for the deschooling of society. In the introduction to his controversial book published in 1971, Illich summed up his position as follows:

> *The pupil is thereby 'schooled' to confuse teaching with learning, grade advancement with education, a diploma with competence, and fluency with the ability to say something new.[52]*

Illich argued that a good education system should have three purposes: (1) provide all who want to learn with access to available resources at any time in their lives; (2) empower all who want to share what they know with those who wish to learn from them; and (3) all who want to present an issue to the public should be furnished with the opportunity to do so. Illich called for the replacement of institutionalized schooling by community-driven networks or 'opportunity webs.' These opportunity webs would enable learners to be in control of their own learning with teachers offering their services in an entrepreneurial fashion.[53] He identified four main networks or opportunity webs. The following extract from Deschooling Society summarizes the four networks Illich proposed.

> *Educational resources are usually labelled according to educators' curricular goals. I propose to do the contrary, to label four different approaches which enable the student to gain access to any educational resource which may help him to define and achieve his own goals:*
>
> 1. ***Reference Services to Educational Objects***-*which facilitate access to things or processes used for formal learning. Some of these things can be reserved for this purpose, stored in libraries, rental agencies, laboratories, and showrooms like museums and theaters; others can be in daily use in factories, airports, or on farms, but made available to students as apprentices or on off hours.*
> 2. ***Skill Exchanges***--*which permit persons to list their skills, the conditions under which they are willing to serve as models for others who want to learn these skills, and the addresses at which they can be reached.*
> 3. ***Peer-Matching***--*a communications network which permits persons to describe the learning activity in which they wish to engage, in the hope of finding a partner for the inquiry.*
> 4. ***Reference Services to Educators-at-Large***--*who can be listed in a directory giving the addresses and self-descriptions of professionals, paraprofessionals, and free-lancers, along with conditions of access to their services. Such educators, as we will see, could be chosen by polling or consulting their former clients.[54]*

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[50] Roberts, P. (2000). *Education, Literacy and Humanisation. Exploring the works of Paulo Freire*. London: Bergin Garvey.

[51] Raynolds, H. (1993). Preface, pg. 11. In, Freire, P., *Pedagogy of the City*. New York: Continuum.

[52] Illich, I. (1970). *Deschooling Society,* p.4. London: Marion Boyars.

[53] Ibid.

[54] Ibid, pg. 56

Although, at the time of writing Deschooling Society in 1971, the World Wide Web was not yet in existence and Illich's approach was not practicable, the technologies needed to realize the four networks described above are now available in various forms, although such networks have not replaced formal schooling in the manner envisaged by Illich. The links between Illich's four networks and the potentials made real by the Internet have been documented more recently by educational technology researchers, and it might be timely to re-look at some of Illich's ideas when reconsidering approaches to schooling.[55]

Noam Chomsky

Although trained as a linguist, the well-known academic and activist Noam Chomsky also engaged in debates about schooling in the context of education and its role in democracy. His writings have considered especially the implications of the growing privatization of education – at school and universities – in the USA, and rapidly rising costs of education. The growing privatization of education, Chomsky argues, is well suited to the spirit of today's age to 'gain wealth, forgetting all but self.' Considering educational reforms in the USA, such as 'No Child Left Behind' and 'Race to the Top', Chomsky argues that such approaches to education kill creativity, 'deaden the mind' and make students increasingly passive (and so easier to control), and in this way schooling has increasingly become a societal disciplinary technique.[56] Consider the following example provided by Chomsky:

> Schools are designed to teach the test. You don't have to worry about students thinking for themselves, challenging, raising questions. And you see it down to the lowest level of detail. I give a lot of talks in communities and places where people are concerned about education and I've had teachers come up to me and say afterwards, you know, I teach sixth grade. A little girl came up after class and said she was interested in something that came up in class, and wanted to know how to look into it. And I tell her, you can't do it; you got to study for the test. Your future depends on it; my salary depends on it.

Instead of deadening the mind, Chomsky states that education should foster the joy of discovery and creativity. Students should learn how to do things for themselves, how to be independent thinkers and actors, and how to develop a questioning approach to what one learns and also towards the world in general. Chomsky is also critical of the value of standardized assessments. While tests can serve purposes of formative feedback for both students and teachers, when used simply as a hurdle that needs to be cleared, there is little value. The majority of education systems are currently geared to getting children to jump over hurdles rather than developing their creativity, exploring their interests, becoming active inquirers, solving problems and creating a love of discovery, and thus building the intrinsic value of education. He argues that teaching should be about inspiring students to discover on their own, to challenge if they do not agree, and to look for alternatives. Education should be about getting students to the point where they can learn on their own because that is what they will need to do for the rest of their lives.[57] In Chomsky's words:

> What's important for a person, at any level, is cultivating their own abilities to think for themselves. To inquire, like the 6th grade kid who wants to look into some other topic: to just encourage those elements of a person's nature. Every child has it: that's why kids are asking

[55] Hart, I. (2001). Deschooling and the web: Ivan Illich 30 years on. *Educational Media International*, 38 (2-3): 69-76. Retrieved from http://dx.doi.org/10.1080/09523980110041449a

Wheeler, S; Yeoman, P. and Wheeler, D (2008). The good, the bad, and the wiki: Evaluating student-generated content for the collaborative learning. *British Journal of Educational Technology*, 39 (6): 987-995.

[56] Chomsky, N. (2013). The Corporate Assault on Public Education. Our kids are being prepared for passive obedience, not creative, independent lives. Retrieved from www.alternet.org/education/chomsky-corporate-assault-public-education?paging=off&current_page=1#bookmark

Chomsky, N. (2012). The Corporate Assault on Education. Available from http://www.youtube.com/watch?v=DbMP-cy1INA

Chomsky, N. (2012). The Purpose of Education. Available from http://www.youtube.com/watch?v=DdNAUJWJN08

Noam Chomsky interview with Roy Donovitch.(2013). Reflection on education and creativity. Available from http://www.youtube.com/watch?v=aDx2-mdInhI

[57] Chomsky, N. (2012). The Purpose of Education. Available from http://www.youtube.com/watch?v=DdNAUJWJN08

questions all the time, and can drive their parents crazy with questions because they want things to make sense, to understand it and so on. And that can be encouraged from a young child to graduate school. Then, it doesn't really matter what you learn, because you are capable of learning what matters to you.[58]

Henry A. Giroux

Another public intellectual, who has voiced his critique of education, including schooling and university, is Henry A. Giroux. Giroux is a Professor of English and Cultural Studies at McMaster University and has written widely on the functions of education in our current society, together with visions for a different future. His work raises some important points about the decline of democratic education in America's public schools (and arguably in many other parts of the world too). Like Chomsky, Giroux is critical of the growing bureaucratization of schooling and the reduction of teachers to specialized technicians in the educational machine that is promoted by policy such as 'No Child Left Behind'.[59] In a recent opinion piece, Giroux argued that schools have become 'testing hubs that de-skill teachers and disempower students.'[60]

For Giroux, like Friere with whom he worked closely, education is both moral and political practice, the purpose of which should be to 'introduce students to the great reservoir of diverse intellectual ideas and traditions, but also to engage the inherited bodies of knowledge through critical dialogue, analysis and comprehension.'[61]

Ken Robinson

Since his widely viewed 2006 TED Talk entitled, 'How schools kill creativity'[62], together with his writing[63] and later talks (for example, TED 2010), the ideas of Sir Ken Robinson have also powerfully drawn attention to the need to reconsider the institution of schooling and what schooling does to creativity and innovation, particularly in the context of the global knowledge society which functions very differently compared to the industrial age. As was noted above, Robinson argues that creativity is as important as literacy in education and should have the same status, especially so in a context where we do not know what the future holds with technological change that is so rapid. Yet schooling today educates young people out of creativity due to the emphasis placed on avoiding mistakes (Robison argues that making mistakes is a central part of creativity and innovation), as is particularly evident in the growing focus on teaching to the test and standardised assessment.[64] Schooling (and education more broadly) is based on an extremely limited understanding of intelligence, that of academic performance. Robinson argues that education needs to recognize the diversity of human

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[58] Noam Chomsky interviewed by Arianne Robichaud. (2013). Retrieved from http://www.chomsky.info/interviews/20130326.htm

[59] Giroux, H.A (2002). Teachers as Transformative Intellectuals. *Educate*, 1: 46- 49. Retrieved from http://www.sef.org.pk/old/Educate/education/Teachers%20as%20Transformatory%20Intellectuals%20by%20Henry%20Giroux.pdf
Giroux, H.A (1988). *Teachers as Intellectuals: Towards a Critical Pedagogy of Learning*. Westport, CT: Bergin and Garvey. Available from http://www.youtube.com/watch?v=DgdVCnTTqXA

[60] Giroux, H.A. (2013). When Schools Become Dead Zones of the Imagination: A Critical Pedagogy Manifesto. Retrieved from http://www.truth-out.org/opinion/item/18133-when-schools-become-dead-zones-of-the-imagination-a-critical-pedagogy-manifesto

[61] Girioux, H.A. (2012). Rethinking the Promise of Critical Education. http://www.truth-out.org/archive/item/81318:henry-giroux-rethinking-the-promise-of-critical-education

[62] Robinson, K. (2006). How Schools Kill Creativity. TED video. Recorded February, 2006 in Monterey, California. Retrieved from http://www.ted.com/talks/ken_robinson_says_schools_kill_creativity.html

[63] Robinson, K. (2011 – 2nd edition, first edition published in 2001). Out of our Minds. Learning to be creative. Capstone Publishing.
Robinson, K. (2009). The Element. How Finding Your Passion Changes Everything. London: Penguin Books.

[64] Robinson, K. (2006). How Schools Kill Creativity. TED video. Recorded February, 2006 in Monterey, California. Retrieved from http://www.ted.com/talks/ken_robinson_says_schools_kill_creativity.html

capacities and the need to educate the whole being, rather than the head only. To do this, a radical re-think of education is essential.

According to Robinson (2010), there are three main principles on which human life flourishes, but these are currently contradicted by our approach to education.[65] First, human beings are naturally different and diverse – but education is based on conformity and an over privileging of maths, science and technology at the expense of the arts and humanities. Second, children are natural learners due to their curiosity and related creativity – but education sees the profession of teaching as a 'delivery system' measured by standardized tests, rather than a creative process that facilitates meaningful learning. Third, human life is inherently creative, and this underpins our diversity – but education encourages compliance, standardization, and conformity rather than awakening and empowering creativity.

Robinson argues that, instead of the dominant mechanistic conceptions of education, it should be seen as first and foremost a human system, a system about people. Once it is conceived as a human system, one can begin to identify the conditions under which people thrive and learn. The real role of leadership in education should not be command-and-control (as is common in technocratic systems), but rather that of creating a climate of possibility.[66]

Building on this long history and burgeoning interest in alternative approaches to schooling, there is now a TED Talks playlist focused on Re-imagining Schools.[67] In addition, there is a growing body of recently published research critiquing traditional education, and proposing various solutions. Some recent examples include:

- John Abbot with Heather MacTaggart (2010). *Overschooled but Undereducated. How the crisis in education is jeopardising our adolescents*. London: Continuum.
- Clayton M Christensen; Michael B. Horn; & Curtis.R Johnson (2011). *Disrupting Class. How disruptive innovation will change the way the world learns*. McGraw Hill.
- Salman Khan (2012). *The One World School House. Education Reimagined*. Great Britain: Hodder & Stoughton.
- James Paul Gee (2013). *The Anti-Education Era. Creating smarter students through digital learning*. New York: Palgrave MacMillan

The following section presents a series of case studies of schooling innovation (based exclusively on desk research). The aims are to:
1) Demonstrate examples of the potential of moving beyond the bounds of traditional schooling;
2) Create an imagination for what might be possible in re-thinking approaches to schooling; and
3) Explore the potential of technology to support schooling innovation.
This then creates a context for considering what role OER may play in facilitating such changes.

It is important to emphasize that the argument being presented is not that technology per se can lead to schooling change, but that technology can be usefully employed to support broader systemic school reform. Indeed, the first case study presented below dates back to 1921, and, although technology is widely used in the school today, technology did not drive the change. That said, the dramatic speed at which technology is evolving at present does need to be harnessed in support of school reform, and certainly cannot be ignored as children now are exposed to technology and technological solutions from birth.

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[65] Robinson, K. (2010). How to escape education's death valley. TED Talks, April 2013. Retrieved from http://video.ted.com/talk/podcast/2013S/None/SirKenRobinson_2013S.mp4
[66] Ibid.
[67] Playlist: reimagining school. Available at http://www.ted.com/playlists/24/re_imagining_school.html

Case Studies of School Innovation

Summerhill School (Suffolk, England)

Summerhill School, [68] an independent school, was founded by A.S Neill in 1921 and still operates on its original founding principles. Neill's philosophy was that school children should have the freedom to attend lessons if they wished to, or to stay away and play – essentially, students can make their own rules. The three major principles on which the school runs are democracy, equality, and freedom. His ideas emerged from his unhappiness with the very rigid forms of discipline he was required to impose on pupils as a teacher at the time. Summerhill School is an example of what has been referred to as democratic schooling. Although Summerhill has attracted a fair number of detractors over the years due to its radical approach to education, in 2007 it was officially approved by the Office for Standards in Education, Children's Services and Skills (OFSTED) following a comprehensive assessment.[69] The aims of the school are to:

- Provide choices and opportunities that allow children to develop at their own pace and to follow their own interests;
- Allow children to be free from compulsory or imposed assessment, allowing them to develop their own goals and sense of achievement;
- Allow children to be completely free to play as much as they like;
- Allow children to experience the full range of feelings free from judgement and intervention of an adult; and
- Allow children to live in a community that supports them and that they are responsible for in which they have the freedom to be themselves, and have the power to change community life, through the democratic process.

Summerhill School is a boarding school, but also has day students. There are usually between 80 and 90 students enrolled at the school at any time from several different countries, and ages range from five years to about 17 years. The school has 12 full time staff members. According to the school's website, the following qualities are commonly developed: 'self-esteem, tolerance, integrity, fairness, understanding, sensitivity, compassion, assertiveness, creativity, individuality, humour, self-motivation, and common sense'.[70] School meetings, which are attended by all students and teachers take place each Monday, Wednesday and Friday for about an hour. At these meetings, the school rules/laws are made or changed based on majority vote.[71]

Like other schools, Summerhill has a school timetable, but students select the subjects they wish to study, and there is no minimum learning requirement. Formal school subjects include: biology, physics, chemistry, mathematics, English, German, Spanish, Japanese, Chinese, woodwork, art drama, history, geography, music technology, studio sessions, information technology and vocal music. In addition, students can also offer or suggest additional classes. These include: gardening, airplane construction, the game of diplomacy, magic lessons, psychology for kids, thinking skills and games, mosaics, photography and photoshop, afternoon walks, plasticene, computer strategy games, writing and making video, making a radio play, chess and macramé. The school also provides a wide range of outdoor facilities for various sports, opportunities for camping, a theatre, music room, skateboard ramp, and well equipped computer room. For an extended extract that explains the philosophy and practice of Summerhill, see Neill's famous book entitled 'Summerhill – a radical approach to child rearing', available at: http://www.summerhillschool.co.uk/pages/general-policy.html.

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[68] A.S Neill's Summerhill School. Retrieved from http://www.summerhillschool.co.uk/
[69] Ofsted. (2007). Inspection Report. Retrieved from
http://www.ofsted.gov.uk/oxedu_reports/download/(id)/90088/(as)/124870_301621.pdf
[70] A.S Neill's Summerhill School. Retrieved from http://www.summerhillschool.co.uk/pages/basics.html
[71] Summerhill School. The meeting. Retrieved from http://www.summerhillschool.co.uk/pages/themeeting.html

Students attending Summerhill can take the GCSE examinations at ordinary level, but the school does not offer A-levels. The school reports that most students take some examinations before they leave the school, but there are some who choose not to. Of those who do take the GCSEs, the results are promising. For example, for the period 1995-1998, the proportion of student achieving the national benchmark of five or more grades A*-C was 46% at Summerhill compared to the national average of 43%. It was also reported that performance improvement over time was greater for Summerhill than nationally. In addition, 63% of Summerhill students in the aggregate group analysed did not have English as a first language, and many could speak very limited English on arrival at Summerhill.[72] In 2011, the school was again assessed by OFTSED and the following conclusions were noted:

- Summerhill School provides a good quality of education;
- Strengths include outstanding spiritual, moral, social and cultural development and outstanding promotion of pupil's welfare, health and safety;
- An outstanding feature is the manner in which the curriculum and learning is tailored to the student's needs; and
- Pupils have an extremely deep understanding of work-related learning. [73]:

Studio Schools[74]

'Studio Schools' is a new concept in schooling education that is being pioneered in the United Kingdom (UK). These schools fall within the public system and publicly funded, but independently run. The head of the Chamber of Commerce in the UK is the chair of the Studio Schools Trust. The main objective of the Studio Schools approach is to tackle the problem of bored teenagers who drop out of school with no job, no hope, and no line of sight regarding their future, together with the challenge of employers complaining about poor employability of young people coming out of school. The name 'Studio School' is based on the Renaissance concept of studios, where working and learning were integrated. Students were taught by an experienced master (such as Leonardo da Vinci) in the workshop where the masters created and produced their work.[75]

Studio Schools target teenagers aged between 14 and 19 years. The schools are small with about 300 students. They operate all year round and have a 9am to 5pm working day so that they function more like the workplace than a school. Studio Schools offer both academic and vocationally oriented qualifications, but specifically seek to break down the divide between academic and vocational training. Learning is taken out of the traditional classroom and delivered through enterprise projects with about 80% of the curriculum being covered through real life practical projects. For examples of Studio Schools' curricula, see: http://www.studioschoolstrust.org/sites/default/files/Introduction%20to%20SST%20projects%202020 13.pdf.

The enterprise projects that form the cornerstone of the curriculum are mapped to the National Curriculum, and students are able to sit for GCSEs if they wish. Currently, there are 27 Studio Schools operating across the UK, with another 13 in the process of being opened.[76]

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[72] Cunningham, I. (2000). Report of an Inquiry Into Summerhill School - Leiston, Suffolk. Retrieved from http://selfmanagedlearning.org/Summerhill/RepMain.htm

[73] Ofsted. Inspection reports-Summerhill School. Retrieved from http://www.ofsted.gov.uk/inspection-reports/find-inspection-report/provider/ELS/124870

[74] This information has been summarised from the Studio Schools Trust website (www.studioschoolstrust.org), as well as the TED Talk presented by Geoff Mulgan, one of the founders of this movement, in 2011. Retrieved from http://www.ted.com/talks/geoff_mulgan_a_short_intro_to_the_studio_school.html.

[75] Studio Schools Trust. Why "Studio" Schools. Retrieved from http://www.studioschoolstrust.org/studio-schools/why-studio-school

[76] Studio Schools Trust. Map of Current Schools. Retrieved from http://www.studioschoolstrust.org/studio-schools/map-current-schools

There are seven key features that form the basis for Studio Schools. These features were identified based on research and consultation with employers, education experts and young people themselves. These seven features are briefly summarised in the table below.

Table 1   Essential elements of Studio Schools[77]

Essential Elements of a Studio School	Description
Academic excellence	Studio schools teach the national curriculum and offer key academic and vocational qualifications. Qualifications offered by specific schools differ depending on the focus of the school and the local context. On completion, students have the full range of progressions routes open to them.
Employability and Enterprise Skills	Employability and life skills underpin all activities at Studio Schools (see below for the Create Skills Framework). The Create framework was developed over four years and based on research and consultation. The curriculum is offered primary through Enterprise projects.
Personalized Curriculum	All students have a personal coach whom they meet with fortnightly. Working with their coach, students develop their own personalized learning plan which allows them to tailor their curriculum to their individual needs and aspirations. Personalization is also supported by the small school environment where all students can access the support needed.
Practical Learning	The core of the Studio Schools curriculum model is enquiry-based learning. Students cover the national curriculum by participating in enterprise projects in the school, local businesses and surrounding community. Most projects involve external commissions so students' learning takes place in an authentic context.
Real Work	A significant proportion of learning time each week is spent on real work placements where they work in local businesses. Students who are 16 years and older earn a way. In years 10 and 11, the students spent four hours per week in work placements and by year 12 and 13 they work two days per week.
Small Schools	Because Studio Schools usually enrol approximately 300 students they are able to offer a personalized learning environment which includes strong pastoral care. Students build strong relationships with their peers and with their life coaches.
Students of All Abilities	Studio Schools are inclusive and comply with the national School Admissions Code.

The curriculum is based on the Create Skills Framework[78] which is underpinned by five principles:
- Accessibility – a simple and easy to use structure;
- Simplicity – no jargon, clear and simple language;
- Transparency – clear assessment criteria for students;
- Transferability – skills are exhibited in a range of settings;
- Evolutionary – a skills framework that evolves over time.

The figure below summarizes the Create Skills Framework.

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[77] Adapted from Studio Schools Trust. Essential Elements of a Studio School. Retrieved from http://www.studioschoolstrust.org/studio-schools/essential-elements-studio-school
[78] Studio Schools Trust. (2012). The CREATE Skills Framework. Retrieved from http://www.studioschoolstrust.org/sites/default/files/CREATE%20Handout%20Oct%202012.pdf

Figure 1   Create Skills Framework[79]
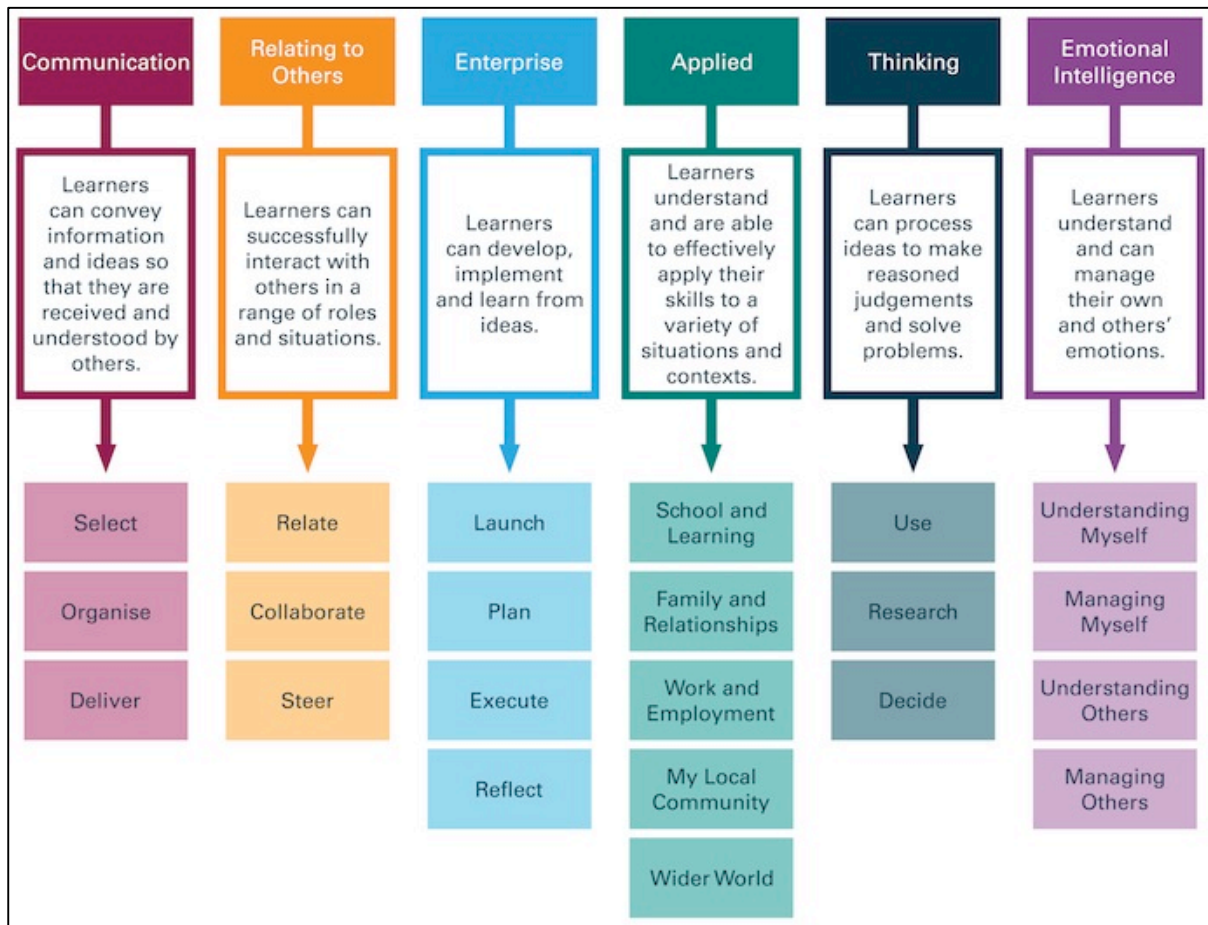
Mulgan (2011) reports that students attending Studio Schools are motivated to learn, and, after two years, the students who participated in the initial pilot project jumped from being some of the poorest performers nationally to the top quartile in the GCSEs (with an average of 9A-C CGSEs).[80]

Virtual Schooling

> [T]he new, publicly funded online schools are proving to be more than merely another delivery system for students. In a wide range of other industries, and now, increasingly in K–12 education, the Internet has enabled deep structural changes. In each case, new organizations developed alternative management structures, distribution methods, and work models.[81]

The virtual school movement initially began within Charter schools (see below). Tucker (2007) reported that, by January 2007, there were 173 virtual charter schools serving 92,235 students across the United States. However, much larger numbers of students participate in various supplemental virtual schooling programmes led and funded in different ways, such as through a school consortium, partnerships with higher education, or state departments of education. A key benefit of virtual

[79] Studio Schools Trust. CREATE Framework. Retrieved from http://www.studioschoolstrust.org/studio-schools/create-framework
[80] Geoff Mulgan. (2011). A short intro to the Studio School. Available at http://www.ted.com/talks/geoff_mulgan_a_short_intro_to_the_studio_school.html
[81] Tucker, B. (2007). Laboratories of Reform: Virtual High Schools and Innovation in Public Education. Education Sector Reports. Retrieved from http://www.educationsector.org/publications/laboratories-reform-virtual-high-schools-and-innovation-public-education

schooling is that multiple levels of personalization are possible, and this takes account of individual differences and preferences. As a result, virtual schools provide a platform for serving students who need remedial support as well as those who need more advanced educational opportunities while at school. While charter schools tend to function in parallel with traditional schooling systems, supplemental virtual schooling is integrated into the traditional system and this potentially opens spaces for virtual schooling to spearhead change in traditional schools.[82]

However, despite its potential, the virtual schooling movement has also been widely criticized (refer also to the section below that focuses on cyber charter schools).[83] Much of the critique relates to the for-profit nature of many virtual schools, particularly about approaching education as a profit-making exercise and what this might mean for quality. (However, it should be noted that not all virtual schools operate on a for profit basis). Anther criticism of virtual schools is that, when compared to conventional brick-and-mortar public schools, full-time virtual schools tend to serve relatively small numbers of Black and Hispanic students, poor students, and those with special educational needs. Performance of students at virtual schools also seems to be somewhat variable, with some examples of schools demonstrating excellence and innovative practices and others of very poor quality.[84]

Two case study examples of virtual schools are briefly presented below – the first a public school, and the second a non-profit cooperative.

Florida Virtual School (FLVS) (http://www.flvs.net/Pages/default.aspx**)**

Florida Virtual School (FLVS), founded in 1997, is a fully online public school offering courses from Kindergarten to grade 12. Students do not need to be based in Florida to enrol at FLVS, however, Florida-based students attend for free while non-state and international students pay tuition fees. All public schools in Florida must provide the option for their students to choose courses through FLVS.[85] When FLVS started in 1997, there were 77 half-credit enrolments, and by 2007 there were 113,900.[86] In 2011, FLVS offered over 110 courses, and enrolled students from 49 states and 46 countries.[87] Annual stakeholder evaluation research has shown that students enrol in courses at FLVS for three main reasons: to improve their grades in specific courses, to accelerate their graduation from high school, or to pursue a personal interest that is not offered by their traditional school.[88]

The motto of the school is: '*Any Time, Any Place, Any Path, Any Pace'*, and this sums up the philosophy underpinning teaching and learning at FLVS. The mission, vision, commitment, and beliefs that provide the foundation for FLVS are summarized in the table below.

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[82] Ibid, pg. 6-7

[83] Molnar, A. (Ed.); Miron, G., Huerta, L., Cuban, L., Horvitz, B., Gulosino, C., Rice, J.K., & Shafer, S.R. (2013). *Virtual Schools in the U.S. 2013:Politics, Performance, Policy, and Research Evidence*. Boulder, CO: National Education Policy Center. Retrieved from http://nepc.colorado.edu/publication/virtual-schools-annual-2013

[84] Molnar, A. (Ed.); Miron, G., Huerta, L., Cuban, L., Horvitz, B., Gulosino, C., Rice, J.K., & Shafer, S.R. (2013). *Virtual Schools in the U.S. 2013:Politics, Performance, Policy, and Research Evidence*. Boulder, CO: National Education Policy Center. Retrieved from http://nepc.colorado.edu/publication/virtual-schools-annual-2013

[85] Florida Virtual School. Accreditation. Retrieved from http://www.flvs.net/areas/aboutus/Pages/accreditation.aspx

[86] Florida TaxWatch Centre for Educational Performance and Accountability. (2012). Final Report: A Comprehensive Assessment of Florida Virtual School. Retrieved from http://www.flvs.net/areas/aboutus/Documents/Research/TaxWatch%20Study.pdf

[87] Mattox, W. (2012). A Leader in Digital Education. How Florida Became One – and Why It Must Remain One. Policy Brief, The James Maddison Institute. Retrieved from http://www.flvs.net/areas/aboutus/Documents/Research/James%20Madison%20Institute%20Policy%20Brief.pdf

[88] American Institute for Research. (2012). Florida Virtual Schools. Stakeholder Surveys 2011-2012. Retrieved from http://www.flvs.net/areas/aboutus/Annual%20Evaluations/Exec2012.pdf

Table 2   Mission, visions, commitment and beliefs of FLVS[89]

	Description
Mission	To deliver high quality, technology-based education that provides the skills and knowledge students need for success.
Vision	To transform education worldwide – one student at a time.
Commitment	The student is at the centre of every decision we make.
Beliefs	• Every student is unique, so learning should be dynamic, flexible and engaging. • Studies should be integrated rather than isolated. • Students, parents, community members, and schools share responsibility for learning. • Students should have choices in how they learn and how they present what they know. • Students should be provided guidance with school and career planning. • Assessments should provide insights not only of student progress but also of instruction and curriculum.

All courses offered are aligned to the Florida Comprehensive Assessment Test (FCAT). FLVS is not accredited as a diploma-granting school, but credits are transferred to the students' local school. Most students enrolled at FLVS are part time and enrol in online courses as supplemental to their standard school curriculum. The learning model places parents as partners in the learning process, and family involvement is valued and encouraged through the provision of a Guardian Account to parents so that they can track their child's performance, monthly progress reports that are emailed to parents, as well as telephone contact at least once per month. The FLVS instructional staff members work together in learning communities. An instructional leader (roughly equivalent to a school principal) provides guidance and oversight to about 55 teachers. Part-time assistants provide additional support to the teachers. Continuous professional development is also emphasized. As a public school, FLVS is state funded, but it is the only public school in the state of Florida where funding is based on student performance. Funding is allocated to the school when a student successfully completes a course.[90]

Overall, the performance of students at FLVS appears positive. The annual stakeholder surveys show good overall satisfaction of parents and students with FLVS courses, and the FLVS learning experience is seen as rigorous and engaging. Most students surveyed reported that the course they did through FLVS was of the same quality or better than courses at their traditional school. Most students agreed that they were given an opportunity (not available at their tradition school) to pursue their own academic goals.[91] Further, a detailed study conducted by Florida TaxWatch demonstrated the success of this schooling model, and concluded that:

> *FLVS students outperformed their state-wide counterparts on two independent assessments, both the Florida Comprehensive Assessment Test and Advanced Placement examinations. They earned higher grades in parallel courses. And this was accomplished with less money than was typically spent for instruction in traditional schools.*[92]
> (see http://www.flvs.net/areas/aboutus/Documents/Research/TaxWatch%20Study.pdf for the full analysis and supporting data)

[89] Florida Virtual School. About Us. Retrieved from http://www.flvs.net/areas/aboutus/Pages/default.aspx

[90] Tucker, B. (2007). Laboratories of Reform: Virtual High Schools and Innovation in Public Education. Education Sector Reports. Retrieved from http://www.educationsector.org/publications/laboratories-reform-virtual-high-schools-and-innovation-public-education

[91] American Institute for Research. (2012). Florida Virtual Schools. Stakeholder Surveys 2011-2012. Retrieved from http://www.flvs.net/areas/aboutus/Annual%20Evaluations/Exec2012.pdf

[92] Florida TaxWatch Centre for Educational Performance and Accountability. (2012). Final Report: A Comprehensive Assessment of Florida Virtual School, pg. 2. Retrieved from http://www.flvs.net/areas/aboutus/Documents/Research/TaxWatch%20Study.pdf

FLVS has received a host of state, national and international awards annually from 1999 to 2013 (for details see: http://www.flvs.net/areas/aboutus/Pages/Awards.aspx).

Virtual High School (VHS)

The Virtual High School (VHS) is a non-profit cooperative which started operation more than 15 years ago, and in 2009 had over 500 schools participating from 29 countries.[93] VHS is based in Massachusetts, but, as is shown below, school participation covers 34 different states in the USA, as well as a host of other countries.

Table 3   The Virtual High School at a Glance [94]

	VHS Statistics
Number of Member Schools	735
Total Student Enrolment in VHS Courses	17,289
Students by Gender	Female: 59% Male: 41%
Number of Unique Course Titles	211
Number of Course Sections	470
Number of US States	34
Number of International Schools	35

A strong commitment to quality is important to the ethos of VHS. The following measures of success are indicated on the VHS website:
• Advanced Placement (AP) pass rate above the national average;
• Course completion rate of over 80%;
• Fully accredited and programmes are award winning;
• Programmes have formed the basis for several grant projects;
• Courses and teaching meet, and exceed, accepted standards.[95]

The VHS collaborative offers various different programmes and courses, including: advanced placement, middle school, courses for the gifted and talented, summer school, credit recovery for students who are falling behind in their traditional schools, as well as a full-time online programme. The full time online programme is 'an accredited solution for students who need an alternative to the traditional classroom environment'.[96] Students enrolled in the full-time programme are provided with study advice, mentors/coaches as well as 24/7 technology support.

The teaching and learning approach of VHS is based on 3 Cs – content, collaboration, and citizenship. This approach is usefully summarized by the ex-CEO of VHS, Liz Pape:

> *VHS students are given the unique opportunity to learn with and from one another in global online classrooms, as they learn course content, gain online collaboration skills, and develop global citizenship skills. No longer are students only communicating and learning with students from their own neighbourhood. No longer are students' world views constrained by their zip code and local culture, and no longer are students taking online courses that offer little beyond*

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[93] The Virtual High School. Available at http://thevhscollaborative.org/
The Virtual High School. Member School Directory. Retrieved from http://thevhscollaborative.org/why-vhs/collaborative-schools/directory
[94] The Virtual High School. The Virtual High School at a Glance. Retrieved from http://thevhscollaborative.org/about-us/virtual-high-school-glance
[95] The Virtual High School. Commitment to Quality. Retrieved from http://www.thevhscollaborative.org/why-vhs/commitment-quality
[96] The Virtual High School Collaborative. Full Time Online Learning for High School Students through VHS. Retrieved from http://www.thevhscollaborative.org/sites/default/files/public/Full%20Time%20Flyer.pdf

content mastery. A student in Massachusetts can discuss politics with one from Dubai. Malaysian students can share their Tsunami experiences first hand with classmates from Alaska. A deaf student in Washington can work on a group project with his hearing classmate in North Carolina, without preconceived notions or stereotypes. Students begin to understand how they are part of a larger global community through the VHS experience they receive within their own local schools. For these students, distant, disparate world events become the fodder for more personally meaningful, connected learning experiences.[97]

All teachers who are part of VHS are required to participate in a graduate-level training programme in online teaching. The 2012 VHS Annual Report noted that more than 16,000 students were reached that year, and performance continued to be strong. It is noted that at VHS 'success is measured one student at a time'[98], ensuring that personalization of the learning process is possible. The AP pass rate for VHS students was 71% compared to the national average of 59%.[99] A series of independent evaluations, both formative and summative, of VHS activities have been carried out and the results are used to inform on going improvements. These evaluation reports are available for download and review on the VHS website.[100]

Cyber/Virtual Charter Schools

Charter schools, based in the United States, are publicly funded schools that are privately operated. A key area of innovation with respect to technology use at charter schools has been seen in the development of cyberschools or full time virtual schools.

Cyberschools are charter schools – publicly funded, fully online schools that students enrol at on a full time basis. The schools can award high school diplomas and other academic credentials. This is different from supplemental virtual schools (see above), where students enrol in online courses in addition to, or as a component of, their traditional school curriculum. In most instances, students who are enrolled in cyberschools learn from home at a personalized pace, sometimes with parental guidance (like home schooling). Enrolment in cyberschools is reported to be growing rapidly in the United States, although the movement remains controversial. Areas of controversy include: funding issues, particularly where students enrol in virtual schools based outside of their assigned district; concerns about quality where some cyberschools do not follow state standards in terms of teacher quality, assessment participation and have low test scores; and concerns about socialization where students spend all their time behind computers with little physical contact with peers and very few opportunities to develop social skills.[101]

The growth of full time virtual schooling, or cyber schools, has resulted in a fast growth of for-profit education management organisations (EMOs). EMOs provide various virtual school products, for example, software, curriculum, instructional delivery, school management services and governance

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[97] Pape, L (2009). Going Global with Virtual High School, p. 2. Perspectives Newsletter.2012. Retrieved from http://thevhscollaborative.org/sites/default/files/resources/Going%20Global%20Article.pdf

[98] The Virtual High School Collaborative. (2012). Annual Report 2012. Retrieved from http://www.thevhscollaborative.org/sites/default/files/public/VHS_Annual%20Report_FINAL_4_26.pdf, pg. 3

[99] The Virtual High School Collaborative. (2012). Annual Report 2012. Retrieved from http://www.thevhscollaborative.org/sites/default/files/public/VHS_Annual%20Report_FINAL_4_26.pdf

[100] Virtual High School. Requestor's Contact Information. Available at http://www.govhs.org/Content/InfoFor-Resource+Docs

[101] Molnar, A. (Ed.); Miron, G., Huerta, L., Cuban, L., Horvitz, B., Gulosino, C., Rice, J.K., and Shafer, S.R. (2013). Virtual Schools in the U.S. 2013:Politics, Performance, Policy, and Research Evidence. Boulder, CO: National Education Policy Center. Retrieved from http://nepc.colorado.edu/publication/virtual-schools-annual-2013/.

[101] Tucker, B. (2007). Laboratories of Reform: Virtual High Schools and Innovation in Public Education. Education Sector Reports. Retrieved from http://www.educationsector.org/publications/laboratories-reform-virtual-high-schools-and-innovation-public-education

support. Molnar et al (2013) show that K12 Inc[102] (one of the largest for-profit EMOs which also runs the K12 International Academy[103]) in the US made an operating of profit of $29 million in 2012 and $708 million in 2013. The large growth in demand for virtual schooling is thus clear. However, complex questions about the social role of schooling, public good issues, and accountability[104] are still to be adequately addressed. Recommendations include the development of new funding models for virtual schooling that, amongst others, ensure that for-profit virtual schools do not prioritise profit over student needs and performance, and include more stringent accountability procedures.

One specific case study example of a cyber charter school is presented below for illustrative purposes.

The Pennsylvania Cyber Charter School (PA CYBER)[105]

PA CYBER offers a range of curriculum choices from K-12, depending on the needs of the specific student. In addition, students can choose whether to enrol in an asynchronous learning course which is self-paced and done in one's own time, or a synchronous course which implies real time learning. Synchronous courses are more similar to traditional classroom environments since technology is used to create a virtual classroom environment where spoken, written and auditory communication between teachers and students takes place. Once enrolled, a personalised education plan is created for each student and each student is assigned an instruction supervisor (IS). The IS plays a pivotal role in the learning journey and is a certified teacher. The IS works with the student and family to choose the best curriculum given the needs and interests of the student. All courses and curricula are approved by the Pennsylvania Department of Education.[106]

In order to foster a sense of connectivity and provide opportunities for interaction in person, a series of special programmes are offered. These include informal get-togethers and organised activities that connect virtual classmates and the families; family-friendly educational field trips; and opportunities to further interests in fine arts through a partnership with the Lincoln Park Performing Arts Centre.[107]

Statistics for the 2011-2012 year provided by the Pennsylvania Department of Education Division of Data Quality indicate that PA CYBER delivered a total of 1,513 high school graduates, of which 1,103 (72.9%) were college bound. This performance is slightly higher than the state average across all public schools (traditional, charter and virtual) where a total of 71.4% of graduates were college bound.[108]

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[102] K[12]. Available at http://www.k12.com/
See also: Saul, S. (2011). Profits and Questions at Online Charter Schools. The New York Times. Retrieved from http://www.nytimes.com/2011/12/13/education/online-schools-score-better-on-wall-street-than-in-classrooms.html?pagewanted=1&_r=2&
[103] K[12] International Academy. About Our School. http://www.icademy.com/about
[104] Saul, S. (2011). Profits and Questions at Online Charter Schools. The New York Times. Retrieved from http://www.nytimes.com/2011/12/13/education/online-schools-score-better-on-wall-street-than-in-classrooms.html?pagewanted=1&_r=2&
[105] The Pennsylvania Cyber Charter School. Home Page. Available from www.pacyber.org
[106] The Pennsylvania Cyber Charter School. Curriculum Overview. Retrieved from http://www.pacyber.org/curriculum.jsp?pageId=216139224060129190214001
[107] The Pennsylvania Cyber Charter School. Special Programs. Retrieved from http://www.pacyber.org/curriculum.jsp?pageId=216139224060128930902323
[108] Pennsylvania Department of Education. Graduate data and Statistics. Retrieved fronm http://www.portal.state.pa.us/portal/server.pt/community/graduates/7426

Self-Organized Learning Environments (SOLE)/ School in the cloud

The concept of Self-Organized Learning Environments (SOLE) was developed by Sugata Mitra,[109] who originally began the Hole in the Wall experiments in New Delhi in 1999. Mitra's research has shown that children can learn almost anything on their own when given unrestricted Internet access. This type of learning is driven by questions, not providing answers, and requires mediation (through the posing of questions).[110] In his 2013 TED Talk, 'Building a School in the Cloud', Mitra argued that learning is the product of self-organisation, it is not about *making* learning happen, but about *letting* it happen. SOLEs have been shown to be one means of letting learning happen.

The focus of SOLEs is on inspiring children aged 8-12 years to 'tap into their innate sense of wonder and engage in child-driven learning'.[111] Child-driven learning has the following characteristics. It is:
• Self-organized;
• Curious;
• Engaged;
• Social;
• Collaborative;
• Motivated by peer interest; and
• Fuelled by adult encouragement.

Essentially, SOLEs are created when 'educators and/or parents encourage kids to work as a community to answer their own vibrant questions by using the Internet'.[112] SOLEs experiments have been implemented across the world[113] in formal schools, homes and communities, and there is growing evidence of the value of this approach for improving children's learning.[114]

In addition to children's self-learning, there is also a place for mediated learning – called Self Organised Mediation Environments (SOMEs). Mitra's initial experiment in the use of SOMEs was done with the help of retired teachers in the UK. Mitra placed an advertisement in the Guardian newspaper asking for retired teachers who were willing to volunteer time interacting with children in Hyderabad, India using technology. This approach has become known as 'The Granny Cloud', where retired teachers are skyping with children in India and Columbia with a focus on encouraging, nurturing, praising and offering guidance, rather than directing, instructing, and examining.[115] Activities include reading stories, conversing, singing, and general support of children's learning through questioning. More research is planned, pending funding, to understand the impact of this mediation on children's English,

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[109] Prof Mitra and his team have conducted a wealth of sustained research in this area. For links to all of his work, please see http://sugatam.wikispaces.com/home

[110] SOLEs and SOMEs. Vision for a new education for children. Retrieved from http://solesandsomes.wikispaces.com/Vision+for+a+new+education+for+children

[111] Mitra, S. (2010). SOLE - How to Bring Self-Organised Learning Environments to Your Community. Retrieved from media.ted.com/storage/prize/SOLEToolkit.pdf

[112] Mitra, S. (2010). SOLE. How to Bring Self-Organised Learning Environments to Your Community, p. 4. Retrieved from media.ted.com/storage/prize/SOLEToolkit.pdf

[113] See http://solesandsomes.wikispaces.com/SOLE+Experiences+across+the+world for examples.

[114] Dangwal, R. and Gupta, Z. (2012). The impact of IT literacy through HiWEL learning stations on juvenile children. *British Journal of Educational Technology*, 43(2): E117-E124.
Mitra, S. (2005). Self organising systems for mass computer literacy: Findings from the 'hole in the wall' experiments. *International Journal of Development Issues*, 4(1): 71-81.
Mitra, S. and Dangwal, R. (2010). Limits to self-organising systems of learning – the Kalikuppam experiment. *British Journal of Educational Technology*, 41(5): 672-688.
Dangwal, R. and Kapur, P. (2009). Learning through teaching: Peer-mediated instruction in minimally invasive education. *British Journal of Educational Technology*, 40(1):5-22.
Inamdar, P. and Kulkarni, A. (2007). 'Hole-In-The-Wall' Computer Kiosks Foster Mathematics Achievement – A comparative study. *Educational Technology and Society*, 10(2): 170-179.

[115] The Granny Cloud. About. Retrieved from http://grannycloud.wordpress.com/about/

social interaction skills, value systems and school performance,[116] although there is initial evidence of the value of this approach in the context of children (aged between 8 and 14 years) learning molecular biology for the first time supported by an adult mediator without subject-specific knowledge. Mitra and Dangwal (2010, p. 681) state that 'the progress made by the students alone [working in a self-organized learning environment outside of the classroom in a poor rural village] was considerable and it [their performance] was enhanced to the level of good formal schooling [well-resourced urban school] through encouraging, friendly but not knowledgeable mediation'.[117]

Towards a School in the Cloud….
Mitra outlined his vision for a school in the cloud in his 2013 TED Talk. He argues that schools as they are today are obsolete, outdated, and no longer needed in their current form given the changing nature of society and the world of work. He asks whether we are reaching a point where going to school is no longer needed and are in a context where knowing has become obsolete? Rather than knowing, what we need is the ability to access information and use it to solve problems.

Essentially, the school in the cloud model proposed is based on the SOLE approach, where broadband, collaboration and encouragement are brought together. Schools in the cloud are based on a curriculum of big questions. According to Mitra, there is a need to design a new future for learning. The School in the Cloud would allow children from across the world to go on intellectual adventures driven by big questions that mediators in the cloud raise. As a TED Prize winner, Mitra is currently focused on building the School in the Cloud's laboratory school in India using his prize money. This experimental school in the cloud will have only one adult mediator to oversee health and safety of the children, everything else will be run via the cloud using the SOLE approach.

Clearly, many have recognised the shortcomings of traditional education, acknowledging that it is not relevant in preparing learners for today's world. Having outlined these critiques, the next section focuses on the potential of OER to address the shortcomings of traditional education drawing on the critiques of schooling.

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[116] SOLEs & SOMEs. A bit about SOLE and SOME. Retrieved from
http://solesandsomes.wikispaces.com/A+bit+about+SOLE+%26+SOME
[117] Mitra, S & Dangwal, R (2010). Limits to self-organising systems of learning – the Kalikuppam experiment. *British Journal of Educational Technology*, 41(5): 672-688.

Developing an Approach to Systemic Transformation

Introduction

As can be seen from the above analyses, schooling systems are operating in a context in which the changing demands of society and the workplace demand focus on developing key skills and competences, the majority of which are not central to the design of the traditional school system. Critiques of mainstream schooling models are longstanding, and generated a proliferation of micro-level alternatives that have demonstrated significant success in preparing students for the world into which they must graduate. Despite this and notwithstanding widespread rhetoric about the transformative educational potential of OER, as was noted in the introduction the majority of OER initiatives have focused their energy on creating openly licensed materials that largely support these traditional educational models (most notably, through the development of open textbooks). Likewise, school-level innovations are yet to penetrate in any meaningful way into the design of national or state-level public schooling systems, which means the vast majority of students are increasingly poorly served by the public schooling career through which they navigate.

Consequently, there are two key emerging questions that have potential policy implications:
1) What role can OER most effectively play in supporting school-level pedagogical transformation that responds to the kinds of social challenges mapped out above?
2) Given the inherent conservatism in public schooling systems (as evidenced by the inability of longstanding critiques of those systems to lead to any significant systemic transformations), what policy approaches may most successfully initiate such transformation?

To explore answers to these questions, we initiated two action research exercises. The first was an in-depth intellectual engagement with teachers and school leaders at St Peter's College, a private school in Johannesburg, South Africa, followed by an initial pilot exercise to model potentially different applications of OER in mainstream curricula. The second was a year-long engagement with the Minister of Education, Sports, Youth, and Gender Affairs in Antigua and Barbuda in order to begin modelling policy approaches that might create suitable conditions for long-term systemic transformation. Antigua and Barbuda was chosen both for the proactive approach of government in the country to educational transformation and because the secondary schooling system is very small, thus making modelling of systemic change more manageable. Though both of these exercises are in early phases, they have yielded interesting results regarding potential roles for OER in support pedagogical transformation in schooling systems. The findings of this work are documented below.

Developing a Model of Transformation at the School Level: The Case of St Peter's College

In recognizing the need to explore the alternative models, and taking into consideration the potential transformative role that OER has to play, a small scale intervention was carried out at St Peter's College, a co-educational private secondary school located in the north of Johannesburg, South Africa. The school attracts students from a predominately middle class background, and has had much success within the existing education structures.

The school recognizes the limitations of current schooling models, and has engaged in a long-term planning exercise to consider alternative educational models that will enable it to manage the above challenges proactively to the benefit of all students. In a brainstorming exercise, school staff noted

that, despite their students' success in the South African Senior Certificate matriculation examinations, they felt that the education they provided could be better tailored to prepare students for the challenges they would face once they leave school. Additionally, they raised their concerns of providing students with better skills to integrate into the world of work and/or tertiary education, fostering a personal connection with their wider community, and developing skills and a curiosity to learn that would allow students to continue to develop and adapt to new and changing contexts they would confront after school. They also felt uncomfortable that they designed lessons based on the needs of an average student rather than tailoring education to each learner's strengths and interests. Based on these discussions and feedback from educators, administrators and senior management, a proposal for a new education model for the College was developed.

Setting the Context

A key challenge for St Peter's College is to ensure that its educational experience provides students at the school the most effective and thorough preparation possible for further education, subsequent career pathways, and their future lives as ethical and engaged social citizens. This challenge is, though, becoming increasingly difficult to achieve at schools because the current model of schooling places such heavy emphasis on success in a formal, externally defined curriculum (in the case of the College, the Independent Examinations Board, or IEB, curriculum) and organizing students into age-based cohorts (i.e. grades) that work through this curriculum one subject at a time and in scheduled classes of limited duration. While the aim of Secondary schooling is, at least in part, to *qualify* (achieve a qualification), it is also to *educate* and it is no longer clear that our children are being adequately educated for the times in which they live.

While this model has dominated schooling for the last 200 years, it is ill equipped, from the perspective of the College, to tackle key challenges facing all schools currently. In particular, there are a few key trends worth noting briefly:

1) The increasingly ubiquitous penetration of ICT of all kinds has precipitated widespread disruption of almost all social systems, generating ongoing social change and systemic disruptions for which our societies globally are not well prepared. Key amongst these is the speed with which jobs are being destroyed and new careers proliferating, with the result that development of the ability to take control of their own programmes of learning continually throughout life becomes of premium importance.

2) The growing diversity of ICT devices and rapidly declining cost of connectivity means that growing numbers of people have increasingly ubiquitous access to the Internet, yet there has been no meaningful educational response to dealing with the realities of this situation (particularly for young people).

3) Declining costs of technology mean that the tools of content production are widespread and being used to produce and share content of many kinds in historically unimaginable abundance, including growing numbers of freely available resources of multiple media that are specifically focused on school education. This has at least two implications:

   a) Using teachers to 'talk' the curriculum to students has now become the least efficient and most costly way to communicate information, but this approach largely still dictates the patterns of time use in the average school day (hence, the principle of individual teachers teaching subjects to age-based classes of students).

   b) As content is digitized and the tools of production/adaptation are readily and cheaply available, this introduces significant potential for students and teachers to become active producers of knowledge during educational activities, rather than largely passive consumers.

4) Massively expanded information access demands strengthened educational emphasis on developing skills and competences that have historically not been a focus for education systems (with the exception of the first listed below). These include:

a) The ability to read and write effectively;
b) The ability to understand the mathematics behind abstract models;
c) The ability to solve problems that lack explicit rules-based solutions, together with the necessary problem-solving attitude (willingness to engage new problems);
d) The skills of complex communication;
e) Creative thinking capacity and the corresponding willingness to make mistakes, fostered through the development of intelligence in all of its diversity and forms;
f) Coherence and discipline in thinking;
g) Competences and knowledge to be able to navigate through ethical dilemmas effectively and positively;
h) Skills to cope with increasing choice effectively and responsibly, to remain decisive and able to act, without succumbing to the debilitating illusion that the choices we have not made are the better ones;
i) The skills and competence to become creators of knowledge, combined with the aptitude to share the results of knowledge creation through online communities of practice;
j) Taking full responsibility for learning and for progress, while tapping into support systems provided.

Educational systems that predominantly plan and organize educational programmes and priorities on behalf of students do not lend themselves well to development of these skills and competences.

Given these challenges, the College is engaged in a long-term planning exercise to consider alternative educational models that will enable it to manage the above challenges proactively to the benefit of all students. The ideas presented below are provisional, and intended to provoke further debate and discussion about suitable new educational models for the College, but they provide interesting options for further research and investigation.

Organizing Principles

St Peter's College is an independent co-educational Anglican day school espousing Christian values and providing a balanced, caring, varied and modern environment. Our aim is to ensure that each individual achieves their potential through exposure to a wide range of excellent academic, sporting creative, cultural, community and entrepreneurial activities based on international standards.

Our goal is to create and maintain an environment where trust and respect for individuals prevail, where diversity is valued and where individual responsibility is fostered within the context of teamwork.

The unique contribution of each student, staff member and parent is valued within an environment of opportunity, thereby providing the inspiration necessary to equip our students with the knowledge, skills and confidence required to succeed in the world.

Within the scope of this mission, the following principles were identified as important in developing a new educational model for the school.

1) The focus of any new educational model should be on fostering the following key attributes amongst students: strong moral and ethical framework; independent thinking; self-motivation, ambition, and drive; internal responsibility for deadlines and punctuality; initiative; and a practical outlook.
2) Any changes made to the educational model of the College must improve the overall performance of students in the IEB examinations at the end of Grade 12.

3) Changes should, in broad terms, be made without incurring substantial investments in physical facilities or requiring new staff appointments. Thus, any new educational model should, at least, not increase fees charged; ideally, it should lead to reductions in operational cost over time.

4) Educational experiences should seek to achieve a suitable balance between the academic and vocational, catering increasingly for wider choices by students about their future life pathways than those enshrined in the traditional school curriculum.

5) The model should allow for individualized progress, enabling individuals to work as fast and as comprehensively as their potential and time will allow.

6) Meaningful change will require integrated planning and scheduling across subjects and grades, in order to create more flexible daily schedules and cross-curricular integration and assessments.

Towards a New Educational Model: Initial Ideas

In planning a new educational model for St Peter's College, it was agreed that – to have practical effect – strong emphasis needs to be placed on the use of time within school days, weeks, and years. Rigidly timetabled days, with pre-defined vacation times place significant constraints on productive, efficient use of time by both teachers and students. Many of the ideas below focus on more optimal, flexible use of time, to create space for a wider range and variety of structured educational activities. These ideas are outlined below:

1) Individual students will be expected to take responsibility for their own learning, so that current dependence on scheduled subject classes can be eliminated as a basis for students working through the curriculum. This will mean that, with support from their teachers, all students will be required to:
   a) Set their own learning targets and programmes of work for each subject, noting that they will be able to work through the curriculum at their own pace rather than a pace artificially defined by the teacher for an entire student cohort);
   b) Define deadlines for achievement of targets, while developing an internalized understanding of the reality that there are often serious consequences for failure to adhere to their own deadlines;
   c) Help to develop and work through structured pathways of learning – with associated multimedia content (print, video, audio, computer-based multimedia) – for each subject, developed in an institutional learning management system (that enables tracking of student progress towards defined learning outcomes of the curriculum);
   d) Submit regular online assessments, according to their defined schedule, to demonstrate and track progress (with emphasis placed on using these to provide ongoing formative feedback from teachers and to monitor learning progress, but with a clear structure that seeks to eliminate pointless homework assignments and subsequent marking);
   e) Work with a 'study buddy' to build in a level of joint accountability for achieving learning objectives (but possibly ensuring these pairings are changed every term or at least annually);
   f) Complete formal subject assessments/examinations when ready rather than according to a single annual schedule.

2) Scheduling will seek to shift use of face-to-face time from traditional classes to tutorial sessions (using a 'flipped classroom' model, where students work through content – videos, print, etc – before sessions), in order to ensure establishment of continuous feedback loops for students. Timetabling will then allow for:
   a) Sessions where students teach each other, within and across grade levels;
   b) Longer study sessions, where large groups of students work together in more open spaces (say, 40-60 students at a time), working alone or in small groups, with multiple teachers on hand to help to solve problems, engage the students, and manage the working environment;
   c) Special sessions where external experts/community leaders are brought in to teach students;

d) Opportunities for non-educational staff members to teach students.

3) As students will take greater responsibility for their own learning, this should free up time of teachers to:
   a) Design more effective teaching and learning environments and assessments;
   b) Provide more individualized support to students;
   c) Invest in ongoing professional development;
   d) Interact more regularly with their peers, both within the College and, virtually, around South Africa and globally;
   e) Place greater emphasis on problem-based assessments in the overall mix of student assessment, as these are more valuable and 'realistic';
   f) Conduct integrated planning of subject teaching, with a view to:
      i) Eliminating teaching the same work and skills in different subjects (saving teacher and student time);
      ii) Introducing more cross-curricular assessment.

   A key objective in this regard should be to remove the requirement for teachers to work in the evenings, which is ultimately detrimental to productivity.

4) Given the above flexibilities, it will become possible to use time freed up by self-paced study and integrated tutorial sessions to introduce:
   a) Structured community projects, to be selected by students, with guidance and parameters supplied by the College (which might include activities such as Habitat for Humanity);
   b) Ongoing entrepreneurial/enterprise projects, in which students work in groups and/or alone to explore and develop their own interests, while demonstrating the connections of these projects back to the formal curriculum.

5) Introduce an overarching system for tracking progress (possibly framed along the lines of a gaming-type rewards system called the 'Game of Life'). This would include built-in incentives to complete tasks across a wide spectrum of curricular, community, entrepreneurial, sporting, and extra-curricular activities, with student earning points or a virtual currency as they progress.

Key Requirements

Moving towards a new educational model requires careful planning and support. The following were identified as priorities to support an effective move:

1) Once the basic tenets of a proposed educational model have been finalized and agreed internally, it will be essential to undertake a wide-ranging process of consultation to solicit the views and inputs of parents and students before finalizing the model. This process should focus squarely on building widespread consensus on and buy-in to the new model.

2) Changes will have to take account of specific subject requirements. Each discipline will have a unique set of requirements, which will, at least partly, determine the use of space, time, and resources. It is therefore vital to consult subject specialists for details.

3) A clear programme of teacher professional development (tailored to the unique needs of each teacher), to support the development of new skills required.

4) The above approach will require thorough preparation and expectation-setting for new students. This should take place in the form of a comprehensive eight-week orientation programme at the start of Grade Eight, which serves to re-define student expectations and introduce them to the necessary tools of learning for success. Likewise, there might be a requirement for a 1-2 week expectation setting process at the start of each year and/or term.

5) The above educational model will work most effectively if each student has access to their own ICT device (capable of running a full office productivity suite, thus above the level of tablets and smart phones) and comprehensive on-campus connectivity.

6) With more flexible use of space, it will no longer be necessary for teachers to 'own' a classroom. Instead, each teacher should be provided a dedicated space in which they can work and store their

teaching materials and personal effects. In addition, it will be necessary to include a shared (but private) consultation room for one-on-one engagements with students.

7) Likewise, it will be important to look at more flexible use of all spaces, for example, harnessing the pavilion as an educational space and removing dry walls between some classrooms to create bigger, more flexible study spaces.

8) To maximize flexibility of time use, consideration could be given to:
   a) Introducing multiple, more flexible sessions and a long time for lunch to allow students to decide when to break off from learning activities to take lunch;
   b) Offering some sporting activities at the start of the day, for those students who might find physical exercise a more effective way to prepare for the days' intellectual activities;
   c) Widening the scope for student participation in external sporting activities (such as club sports);
   d) Introducing flexible vacation times for students and teachers, rather than forcing the entire school to close for pre-defined times in the year;
   e) Introducing a structured, web-based communication system between parents, students, teachers, and the school, to replace the current systems that operate predominantly through paper-based communication delivered via classes.

The Challenges of Implementation

In exploring an approach to implementing this new alternative model, cognisance was taken that it would not be feasible to expect schools to move away from current school organizational models unless parents (and teachers) are confident that students will perform as well in the final examinations under a new innovative model as they would under the old model of education. Thus, a phased approach is being adopted in implementing the new education model.

As part of the deliberations on how to best to adopt new teaching and learning methodologies to encourage greater student engagement and responsibility, a small pilot was conducted. The aim was to explore the potential of some technologies and methods to introduce these proposed changes without major disruptions to the existing school processes. It was also a way of gauging student and staff reactions to a change in teaching and learning methodologies. The pilot ran over four weeks during September and October 2013. This pilot places heavy emphasis on harnessing OER to enable student-led content creation, with a long-term view of demonstrating that students can use OER to create self-paced learning environments that significantly accelerate their journey through the formal curriculum. Once this is successfully modelled, it should then become much easier to begin to implement wider changes to school timetabling and resource allocations without alienating parents and teachers.

The pilot exposed students and staff to a Virtual Learning Environment (VLE) called Canvas and a repository of OER that supported the formal curriculum. An Internet search for appropriate OER was conducted to find quality resources for the pilot activities. For the pilot, there were no additional costs incurred by the school, except for time spent by teachers participating in the activity.

The pilot design was influenced by the vision of creating a student-centric learning environment that places responsibility for learning on the students. The pilot plan noted that students should help to develop and work through structured pathways of learning – with associated multimedia content (print, video, audio, computer-based multimedia) – for each subject, developed in an institutional VLE (that enables tracking of student progress towards defined learning outcomes of the curriculum). Additionally, students were required to work with a 'study buddy' to build in a level of joint accountability for achieving learning objectives. A group of 22 Grade 10 students were drawn from an Engineering Graphic Design class, and a further group of 11 was identified from the top-performing

Grade 10 mathematics class. Specific curriculum objectives were identified by the class teachers, which were used to frame the student's pilot activities.

After an initial briefing to students on how St Peter's College was investigating new teaching and learning strategies, sub groups of two or three students were formed. These sets of 'buddies' were allocated a section of the curriculum to develop (either Descriptive Geometry or Financial Mathematics) and provided a set of OER to use as building blocks for the sections of the curriculum they were to compile. Students were tasked with adapting and reorganizing curriculum resources so that they taught formal concepts, content, and skills in ways that were relevant for their peer's age group and interests. They attended a 90 minute facilitated session that provided basic training on how to organize their content and activities into Canvas. They were required to populate the empty VLE with OER, either from the repository or others they had found online and assessed as beneficial. They were also required to create learning activities that meaningfully covered the curriculum objectives. They then had a two-week period to craft and finalize their 'lessons' as an extra curricula activity.

Essentially, students had the task of developing an online learning environment authored by themselves for themselves. The logic of this is that, if such an approach – with quality reviewed by participating teachers rather than the environment being built by them – this would demonstrate effective use of OER to create a 'flipped classroom' environment and could theoretically be replicated across the entire curriculum for all grade levels. There is good educational evidence that this kind of hands-on approach can create more effective learning for students, but it also creates the potential to set up the kind of flexible learning environment anticipated by St Peter's, as it breaks dependence on the teacher or textbook as the primary content source. Importantly, students would also be learning a number of key information literacy skills – working in online environments, searching for resources, reviewing and making content choices, and so on – while working their way through the formal curriculum. The educator's role was to facilitate the creation of this learning environment, offer guidance and mediate problems and conflicts, and to refrain from traditional teaching.

In the final week of the pilot there was an opportunity to try out each other's 'lessons' which was aligned with the recommendation that students should 'teach each other across and within their grades'. There was also time in the last week to collect feedback from the facilitators and students on their experiences.

Findings from the Pilot

Despite the small sample of students involved and competing priorities from the school's regular programme that limited student engagement, the pilot did reveal some interesting findings. A feedback session at the end of the pilot revealed responses from students indicating a reflection of traditional education models and the potential of new approaches:

- *The teacher's explanation is not always understood so it is good to have an alternative.*
- *[I enjoyed] the links to websites that provide different perspectives.*

Students' responses also reflected positively on the access to varied resources and media available both within the OER repository and on the Internet at large. The large choice of resources supports different learning preferences and provides perspectives that can differ from that of the teacher. This challenges a teacher-centred approach to learning where traditionally the teacher is the authority and effective 'gate-keeper' to knowledge. The existence of an OER repository, a selection of appropriate quality open resources, however, guards against the 'paralysis' associated with 'unlimited choice' identified by Barry Schawrtz above.

Importantly, engaging in this small pilot also raised awareness among students to question that use of a single authoritative that is traditionally associated with a particular course of school subject:

- *It is possible to access lots of questions that are different from textbook examples.*
- *Access to Google allows independent search for solutions.*

Other comments reference the students' sense of engagement, control and accountability in designing and/or adapting resources to teach their peers. Students found that working collaboratively was beneficial and easy. In particular, students noted that:

- *[A] collaborative editing team allows for mistakes to be identified and fixed.*
- *Communication with peers and facilitators is easy.*

Students also appreciated that they could exercise their creativity when using this model. They also commented on the platform's ability to let them be creative, and demonstrated this through their selection of images and videos that supported the curriculum but were chosen to appeal to their peers. It is thus hopeful that this model in a small way attempts to counter Ken Robinson's concerns that 'schools kill creativity'.

With regards to technology, this was considered easy to learn by the students. While they did ask for more time to master authoring skills, they found it easy to work in the VLE. There was no dedicated OER repository facility or database developed for the school intranet. The OER were identified via hyperlinks in a spreadsheet. Consequently access to computers and connectivity was essential for the students to be able to locate the resources. Even in a school that is relatively well resourced compared to a state school, access to computers and connectivity was difficult. Pilot funding excluded the opportunity to provide students access to individual mobile digital devices. Instead, they used the school's computer laboratory to compile and experience each other's work. This meant that they were constrained by specific times when they could work on the VLE. Nevertheless, all groups found enough time to create their lessons, but complained that they encountered restricted access – to the computer laboratories in general, and, once online, to sites blocked by the school filtering systems (such as YouTube).

Students raised a concern of the lack of authority linked to their peers' lessons. They feared being taught 'wrong' information or acquiring incorrect skills. This raises the issue of needing to empower students to evaluate and assess the quality of online information, which is an increasingly important skill in an information society.

An evaluation of the student VLE 'lessons' revealed that all the courses were didactic in nature and characterized by large amounts of exposition, with little opportunity for a user to practise or test themselves against the curriculum outcomes. It could be argued that the student designers emulated traditional methodologies because this is what they were familiar with having been taught this way themselves. Thus, implementation of this kind of approach may require some 'un-learning' by students, but this is also likely to change naturally over time as they grow in confidence and experience with practice. Many of the courses were, however, pitched at their peers with graphics and examples relevant for their age group.

Figure 2   A screen capture from a student-generated VLE lesson on Descriptive Geometry. This particular lesson unpacked the differences between 1ˢᵗ and 3ʳᵈ angle projections over five screens and also included a quiz at the end to help peers assess mastery.
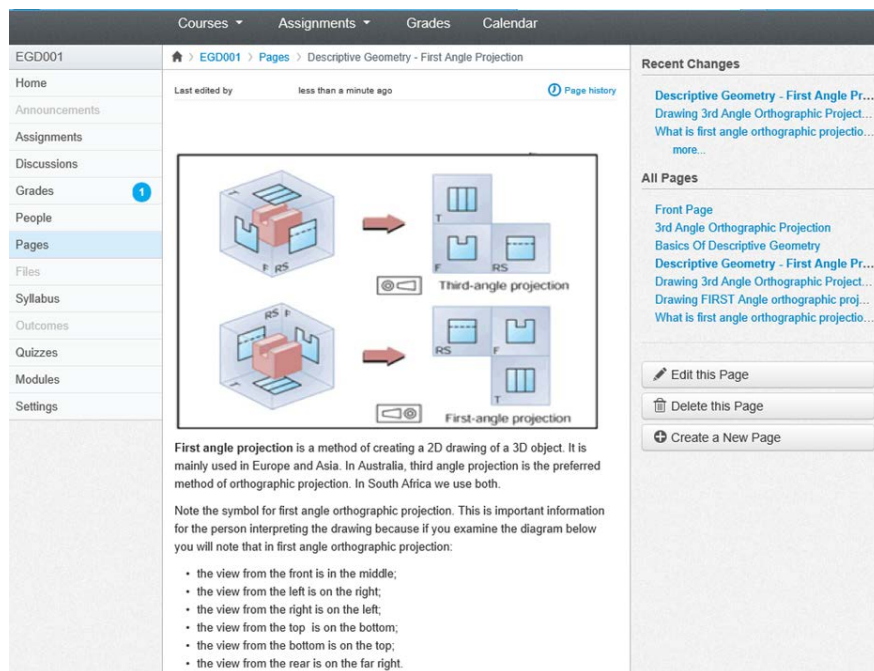
Mitigating factors for the adoption of a traditional approach to lesson design were revealed in student feedback. They asked, in future, for more dedicated time to create their 'lessons' and complained of competing priorities, such completing the curriculum and studying for the end of year examinations, which had robbed them of time to master the technology and limited their ability to be creative. Interestingly when the pilot group was asked to consider the statement 'Is the vision, of establishing a student-centred (and authored) blended learning environment, possible and/or desirable?' the group predominantly endorsed this despite their inability to actualize such an environment during the pilot. It was also significant that reservations raised by a number of individuals about such a future were mostly about whether this education model would prepare them adequately to write existing standardized examinations (which would require a longer-term investigation in order to be full tested). The implication of these particular student concerns is that resistance to a change in the College's education model may, paradoxically, come from successful students, who might feel that their chances of 'success' will be jeopardized, as well as from conservative parents and school board representatives. This is especially true in a school like St Peters College, which performs favourably in exit examinations.

Management Response

On conclusion of the pilot, the findings were shared and discussed with senior management. They regarded the findings as encouraging, and wish to conduct a larger experiment within the Social Studies department during the course of 2014. A second pilot using a larger student group drawn from a subject they believe is more suited to 'blended' learning and that incorporates additional components of the Future Education Model has been proposed. In this second pilot, individual student mobile devices, access to an OER repository, and experimentation with the timetable would be additional areas of focus not covered by the initial pilot. Such a pilot would also serve to spread the

expertise required to facilitate this way of learning amongst a wider staff group than was possible in the first pilot.

Additionally, the College management are committed to developing a phased implementation plan to deploy the Future Education Model. They intend to use the plan to start communicating the education vision with the school's more conservative stakeholders such as students, parents, Old Boys and the Board of Governors. This process of communicating and engaging stakeholders is seen as crucial for implementation success.

Towards Change

While not revolutionary per se, the elements that made up the pilot were important stepping stones to achieving more significant future changes, as mapped out by the College. Important areas that were investigated under this pilot included new roles for students and staff. Students were encouraged to be active and engage the basic skills (literacy and ICT know-how) identified by Levy and Murnane above. Students also began to investigate some advanced skills, such as problem solving and complex communication.

The educators involved also began to experience their new roles as facilitators: fostering coherence and discipline in thinking, especially when preparing curriculum materials for others, coping with the challenges of unlimited choice and encouraging learners to become creators in the educational environment.

From a technical perspective, the pilot ushered in the first use of a VLE by the College and exposure to it by some staff and students will be useful in setting up new initiatives amongst the broader school body in the future. Also any forthcoming initiatives that encourage the proliferation of digital devises for teaching and learning will need such a platform to help structure the learning pathway for students accessing their school work remotely. The use of OER was also a first for the College and the multiple 'voices' and media types contained within the set provided a rich and varied environment very different from a traditional textbook.

The intervention at St Peter's College illustrates an example of how use of this OER VLE prototype allows students the opportunity to learn the curriculum, and facilitates the idea of increasing self-study over time, thereby increasing the scope for introducing greater flexibility in the timetable. In this context, OER was used in a different way, as students were responsible for assembling the content, thereby challenging the notion of the teacher and textbook as the authoritative sources of knowledge. Students were actively involved in deciding on the different content options and refining their work, thereby developing the key skills required in today's world, including information literacy skills.

If such a change in direction is possible at the individual school level, the next issue is to consider how to facilitate an entire system to change in similar directions to those captured in the vision developed by St Peter's College. An attempt to do this was initiated in Antigua and Barbuda, building on an ICT in Education policy engagement funded by the Commonwealth of Learning (COL).

Developing a Model of Transformation Across a System

As has been highlighted, it is increasingly clear that public school systems need to change to be relevant to today's world. However, this change can be difficult as public schools are usually bound by existing policies and practice. Thus, for change to be effective, it needs to be driven at the systemic

level – ideally by government-level policy changes, as these ultimately direct the operations of most public schooling systems. However, such change is difficult as it requires consensus from a wide range of stakeholders, most of whom are inherently conservative in protecting traditional educational models. Likewise, the short-term nature of political appointments inhibits risk-taking in these public systems. Consequently, such change needs to be incremental in nature, so as to create a little disruption as possible and to create buy-in from all stakeholders. Furthermore, this allows for planning the use of technology as a regular occurrence, and not just once-off, allowing to be kept up to date with global trends, and to learn from and respond to previous changes.

In order to test this approach, an action research exercise was conducted. This action research focused on primarily on the secondary school system of Antigua and Barbuda, in order to research and understand the kinds of policy changes that are needed to effect meaningful systemic change in education, so that OER can fulfil its full potential.

Context

Antigua and Barbuda is located in the middle of the Leeward Islands in the Eastern Caribbean, roughly 17 degrees north of the equator. To the south are the islands of Montserrat and Guadeloupe, and to the north and west are Nevis, St. Kitts, St. Barts, and St. Martin. Antigua and Barbuda was chosen as the location for action research as the senior secondary system in that country is very small (just over 25 schools), thus allowing for a better possibility to demonstrate systemic change. Additionally, the Minister of Education, Sports, Youth, and Gender Affairs (MESYG) and the Minister of Telecommunications, Science and Technology both expressed a strong determination to implement significant systemic transformation in schooling, in recognition of the reality that the current schooling system is not adequately preparing students for their future, and is especially not yet contributing to the development of new economic sectors that will reduce current dependence on Tourism and Agriculture. This created the material conditions to be able to re-think the organization and management of schools and the school day.

The vision of the (MESYG)is to encourage lifelong learning and educate our citizens to access and evaluate knowledge through creative problem-solving and critical thinking in preparation for work in a dynamic national, regional and global economy. Its mission is to ensure that all students in Antigua and Barbuda obtain the highest quality education possible from the pre-school to the post graduate level that will enable them to become good citizens who will be able to compete nationally, regionally and globally. Its objective is to work with various stakeholders in the society in order to improve and strengthen our educational, sports and youth empowerment institutions, to develop productive citizens, who can learn and work independently and cooperatively to contribute to their national, regional and global communities.

Within the framework of this vision and mission, the government of Antigua and Barbuda recognizes that knowledge-based activities have become increasingly important. It is this recognition that has prompted Government to develop the use of Information and Communication Technology (ICT) in its daily activities. There has been a thrust in training citizens to use available technology and to become more effective and efficient. Through the introduction of a new ICT in Education Policy for Antigua and Barbuda, it is the Ministry's hope to respond to the change which technology brings to the nature of work and the work place, the so-called 'Knowledge Revolution'. This is paramount for the Ministry, charged with the responsibility to educate the labour force to harness the power of ICT for continued development. It is committed to improving the teaching, learning and administrative processes in the education system with effective use of ICT and to provide all students with the basic ICT skills that are necessary for the information age.

This commitment is consistent with broader regional education policy within the Organization of Eastern Caribbean States (OECS), of which Antigua and Barbuda is a member. The *OECS Education Sector Strategy (2012 – 2021)* (or OESS) articulates a vision for a whole school curriculum that **'**engages school leadership, teacher skills, knowledge and understanding, curriculum leadership, professional learning, data collection and use, sharing and transferring knowledge and good practice, and the use and application of resources and ICT in a cyclical and iterative process' (OECS, 2012). It is also consistent with the Government's current emphasis on Science Technology, Engineering, and Mathematics (STEM), with are a key pillar of national development plans in Antigua and Barbuda.

Ensuring the Necessary Infrastructure: Provision of Tablets to Learners

As a first step in actualizing its commitment to integration of ICT in education, the government of Antigua and Barbuda committed to provide the necessary infrastructure to support change. Through the Ministry of Telecommunications, Science and Technology, extensive ICT infrastructure was supplied to the secondary schooling system, including Community Computer Access Centres (CACs), Mobile IT Classrooms, a one-laptop-per-teacher initiative, and free Internet access.

Additionally, in 2013, the Ministry of Telecommunications, Science and Technology distributed thousands of Samsung Galaxy tablets and free access (7am to 7pm) to mobile 4G LTE connections to every senior secondary student in the country.[118] This effort is part of the Government Assisted Technology Endeavor (GATE) project, which is a multi-million dollar partnership between the Government of Antigua and Barbuda and telecommunications company Digicel. Digicel's partnership with the Government on GATE aims to 'leapfrog Antigua and Barbuda's place in today's regional and global economy'. GATE focuses broadband Internet connectivity, innovation, entrepreneurship, job creation and sustainability.[119]

This clearly demonstrates the government's budgetary commitment to infrastructure, which a first key requirement for systemic change to be possible. However, without a guiding policy environment, such investments are not likely to yield any kind of meaningful systemic change. Hence, development of a new policy environment to leverage the effectiveness of the infrastructure investment.

Shaping the Policy Environment: Development of an ICT in Education Policy and an ICT Master Plan

At the start of the engagement in Antigua and Barbuda, there was no fully developed ICT in Education Strategy, although the country did have other relevant policies such as the Education Act of 2008 and the ICT in Education Policy of July, 2003. Thus, a new policy on ICT in Education was drafted in March, 2013, with financial and technical support from COL and UNESCO, which contains a highly ambitious agenda for educational transformation (see Appendix A for a full text of the policy). It also encapsulates a strong commitment to OER and open licensing. The policy was developed through a consultative workshop process engaging all key stakeholders from the education system.

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[118] Official Website for the Government of Antigua and Barbuda. Thousands of Tablets distributed to Secondary School Students. November 26, 2013. Retrieved from http://www.ab.gov.ag/article_details.php?id=4563&category=38
[119] Government Assisted Technology Endeavour. About G.A.T.E. Retrieved from http://www.gateantigua.com/about.php

Figure 3   The ICT In Education Policy Workshop

The policy was approved by the Cabinet of the Government of Antigua and Barbuda on 18th June 2013. This marked a milestone in Antigua and Barbuda's efforts to modernize and improve education, and in ensuring that the MESYG provides clear leadership in the use of ICT in the education system.

The policy aims to create graduates who are globally connected and competitive through an inclusive approach that allows students' potential to be realized. This is intended to be achieved through a combination of:

- Strategic development of an effective ICT infrastructure;
- Development of appropriate teaching and learning strategies and access to open materials that exploits the potential benefits of ICT;
- Effective use of technology to support education management and administration; and
- Development of human capacity to support the above processes.

Importantly, the ICT Policy highlights the shifting role of educators, from teaching content to facilitating learning, allowing for self-paced learning:

> *3.2. ICT will be harnessed, particularly at the secondary level, to enable more effective use of face-to-face interaction at schools, so that teachers are both empowered and provided the necessary time to shift their focus away from teaching content to supporting and mentoring students who work in increasingly diverse and flexible ways (including self-paced study using ICT infrastructure supplied by Government) during the school day.*

The policy articulates how this approach can mitigate drop-out rates and facilitate self-employment:

> *3.3 Building on the previous commitment, the Ministry will seek to harness both technology and self-paced learning to enable at-risk students to keep pace with the curriculum and to*

introduce more flexible support systems during the school day, thus engaging these students in solving their educational challenges before they drop out of the system prematurely. Emphasis will also be placed on how ICT can be used to assist to develop skills that will assist students to create employment for themselves (through suitable forms of entrepreneurship).

A forward-looking policy of this kind is an important first step in leading systemic change, but it is not a sufficient condition. Consequently, the next step in the process was to work with the MESYG to develop a comprehensive new ICT Master Plan to guide all future procurement and deployment of ICT in schools (See Appendix B for a copy of the full plan). This plan was developed through an extensive consultative engagement, over a period of three weeks, during October, 2013. During this process, the following specific implementation targets were identified:

Table 4   Key Antigua and Barbuda ICT in education targets

Area	Target	By 2014:	By 2015:	By 2016:
Infrastructure & Connectivity	1) Is a database in place that monitors the status of infrastructure and connectivity rollout into educational institutions in Antigua & Barbuda?	Yes	Yes	Yes, integrated into EMIS
	2) Percentage of institutions having any level of Internet connectivity.	75%	100%	100%
	3) Percentage of schools connected at minimum speed of 10 mbps.	30%	65%	100%
	4) Percentage of schools connected at minimum speed of 35 mbps.	5%	25%	50%
	5) Is adequate server and hosting infrastructure and bandwidth in place within the Ministry server environment to host key systems effectively (EMIS, LMS, OER Repository, Ministry website)?	Yes	Yes	Yes
	6) % of all schools (including Antigua State College and Antigua & Barbuda International Institute of Technology) that have adopted an approved ICT in education plan	25%	50%	75%
	7) % of all schools that have revised and updated an approved ICT in education plan	0%	25%	50%
	8) Is a Diagnostic Centre for students with special educational needs operational with all of the technology that it requires?	ICT Integration Plan developed	Yes	Yes
	9) Has an ICT infrastructural standard for schools and school classrooms been developed?	Yes	Yes	Yes (updated)
	10) Percentage of schools that have access to the basic infrastructure required to integrate ICT into their operations:			
	a) Some form of transport access (of sufficiently good quality to guarantee safe and reliable delivery of sensitive ICT equipment).	100%	100%	100%
	b) Safe and secure building infrastructure that conforms to requirements of building standard.	50%	75%	100%

Area	Target	By 2014:	By 2015:	By 2016:
	c) Reliable and stable provision of electricity from a range of appropriate sources.	70%	90%	100%
	d) Telecommunications access, enabling Internet connections.	90%	100%	100%
	11) Percentage of the schools (including ASC and ABIIT) submitting annual ICT Integration Plans, that are equipped with all of the technology solutions that they require in terms of their ICT Integration Plans:	10%	25%	50%
	12) Percentage of teachers, school principals, and school administrators who have their own laptop and access to connectivity through school and/or home	90%	100%	100%
	13) Percentage of Grade 10 and 11 students who have their own tablet device and LTE Connectivity	100%	100%	100%
	14) Percentage of administrators and managers having and using their own e-mail address	50%	100%	100%
	15) Percentage of educators having and using their own e-mail address	50%	100%	100%
Teaching and Learning (including content licensing)	16) Is government policy on intellectual property updated to reflect a commitment to open licensing for government-funded projects?	No	Yes	Yes
	17) Is a national content repository for school content in place?	Yes, integrated into OECS	Yes, with access to curriculum-aligned OER	Yes, with complete CXC coverage
	18) Are government materials online and accessible under an open licence?	Audit of available government materials complete and materials released under CC licence	All newly produced government materials shared under CC licence	All newly produced government materials shared under CC licence
	19) Is a rolling list of content development priorities developed and key content priorities being produced?	Yes	Yes	Yes
	20) Has the MoESYG developed a national set of criteria and tools for evaluating different educational content products?	Yes	Yes	Yes
Management and Administration	21) Is a national EMIS system in place, which is used effectively and meets MoESYG requirements (including pre-schools)?	Yes (excluding pre-schools)	Yes, with pilot for 3 govt pre-schools	Yes
	22) Is an HR Information System operational that covers all educational personnel in Antigua and Barbuda?	Design completed	Yes	Yes, integrated with EMIS

Area	Target	By 2014:	By 2015:	By 2016:
	23) Percentage of schools using ICT applications for the following purposes:			
	a) Management and administration;	50%	100%	100%
	b) Electronic submission of EMIS data;	50%	100%	100%
	c) Communication;	100%	100%	100%
	d) Access to information; and	50%	100%	100%
	e) Teaching and learning.	25%	50%	100%
	24) % schools covered by Student Support Technician Clubs (SSTCs) as primary maintenance and support system	25%	75%	100%
Human Resources	25) UNESCO ICT Competency Framework for Teachers (CFT) adopted in Antigua and Barbuda, with accompanying framework for school principals and administrators	Yes	Yes	Yes
	26) ICT CFT modules (Technology Literacy and Knowledge Deepening) integrated into Associate Degree and Diploma in Education at ASC	No	Yes	Yes
	27) ICT CFT modules (Technology Literacy and Knowledge Deepening) available for delivery as part of in-service teacher training	Technology Literacy only	Yes	Yes
	28) People enrolled in CCTI	50	50	50
	29) Teachers enrolled in ICT CFT in-service modules	100 – TL 0 – KD	150 – TL 100 – KD	200 – TL 150 – KD
	30) Is a training course for school principals on school ICT integration developed?	No	Yes	Yes
	31) Percentage of school principals who have completed training	0%	50%	100%
	32) Is a suitable training course for teacher educators at Teacher Education Department identified?	Yes	Yes	Yes
	33) Percentage of teacher educators who complete a suitable training activity tailored to their professional development needs	100%	100%	100%
	34) Percentage of all educational role-players (including government officials, school principals and management teams, administrators, teacher educators, educators at all levels) possessing the skills and competence required to use ICT effectively in their daily lives.	25%	50%	75%
	35) Percentage of educators using ICT for their administrative and management tasks	50%	75%	100%
	36) Percentage of educators using ICT to directly support teaching and learning	25%	60%	90%
	37) Percentage of educators participating in collaborative collegial networks	15%	30%	60%
Governance	38) Is an e-waste policy approved?	Draft submitted to OECS	Policy approved	OECS facilities operational

Area	Target	By 2014:	By 2015:	By 2016:
	39) The percentage of MoESYG taskforce that makes use of e-administration	75%	100%	100%
	40) ICT in Education Steering Committee operational and meeting regularly	Yes	Yes	Yes
	41) Has the MoESYG developed a change management strategy to support the integration of ICT into schooling and the education system, in line with the requirements of the policy?	Yes	Yes	Yes
	42) Percentage of educational role players that receive or are involved in events or processes that support the change management strategy at least three times per year (including but not limited to messages communicated to them about ICT; newsletters; conferences; workshops; roadshows etc)	50%	100%	100%
Monitoring and Evaluation	43) Has the MoESYG developed and implemented the following frameworks:			
	a) Monitoring framework?	Yes	Yes	Yes
	b) Evaluation framework?	Yes	Yes	Yes
	c) Research framework?	Yes	Yes	Yes
	44) Is an annual baseline of ICT infrastructure, ICT use, and human resource capacity being undertaken?	Yes	Yes	Yes
	45) Percentage of budget dedicated to ICT integration used for monitoring, evaluation and research relevant to the integration of ICTs in schools:	0.5%	1%	1.5%

The activities identified within the Master Plan also encourage interpreting the policy in ways that encourage education transformation. A few examples include a requirement that OER be exploited, that the government release its education materials with an open licence to encourage sharing, that ICT in Education courses be developed for in and pre-service teachers using the UNESCO ICT Competency Framework for Teachers, and that senior secondary students have access to their own digital devices.

Engagement with Schools: The School ICT Integration Plan

The new ICT in Education policy highlights the importance of ensuring that school leaders play a critical role in defining future plans for the use of ICT in classrooms. As part of ensuring that the school's needs and requirements are central to all future planning, the Ministry of Education, Sports, Youth and Gender circulated to all schools a School ICT Integration Plan (see Appendix C for the School ICT Integration Planning Guide and Appendix D for the School ICT Integration Plan Template for schools to complete). The purpose of this plan was to find out:
1) What technology schools already have and whether or not it is working?
2) What plans do schools have for using ICT in the school?
3) What are schools priorities are for buying new equipment?
4) What the competency levels of staff are and what professional development needs do they have?
5) How do schools maintain their ICT and who is responsible for what?

All school principals were requested to complete an ICT Plan for their schools in consultation with their teachers. Completing this plan was a requirement should schools wish to benefit from future ICT support from the Ministry. The objective of this exercise is to ensure that schools are at the heart of the ICT Master Plan, and that all spending on ICT meets clear educational needs. In important ways, therefore, the ICT in Education Policy and Master Plan are modelling a school-centred approach to policy implementation, in ways that would hopefully mirror underlying ethos of the learner-centred approach touted for schools themselves.

Schools have already begun submitting these plans. However, not all schools have completed the plans (at the time of writing, six schools had submitted their plans) and some plans are more detailed than others. It is thus likely that some further engagement with schools will be required in order for schools to complete a detailed ICT Integration Plan. Nevertheless, it is heartening to note that this process of creating plans underway.

OER VLE Prototype for Antigua and Barbuda

Within this unusually proactive policy environment, the OER VLE Prototype discussed in the St Peters example was developed further for use across the secondary school system in Antigua and Barbuda. With additional funding support from COL, an OER repository was added to the Canvas VLE and populated with over 500 mathematics OER from 72 different service providers. These OER were examined for quality, collected, tagged, and stored within the repository. Given the initial complexity of working across an entire system, this initial work was done by a specialist Mathematics educator. These same resources were then organized and sequenced within the VLE component of the prototype so they responded to particular specific objectives as stated in the Caribbean Secondary Education Curriculum (CSEC) Mathematics syllabus. An online mathematics 'textbook' was thereby compiled from available quality free OER. While the prototype could be used like a traditional static textbook (although with integrated multimedia and a range of tools available within the VLE environment), the OER VLE Prototype's real power lies in providing students and educators the tools to manipulate and customize its resources. In addition to accessing and repurposing mathematics content, the prototype also offered automatically marked quizzes and tests providing immediate feedback. Just like the content, these quizzes could be adapted to suit local needs.

It was anticipated that the ability to edit the 'textbook' to suit personal learning preferences and local contexts would, in time, encourage reflective practices amongst students, teachers, principals and education officers as to the nature of traditional practices and create a demand for more flexible approaches to learning and teaching.

Existing open source education tools were used to provide the OER textbook prototype's functionality. Two systems were interlinked, a VLE and a content repository.

Learner Management System (Canvas)

The Open Source Canvas VLE was deployed. The main reason for selecting this VLE was that its interface allowed for seamless transition and easy navigation between resources of different formats. Consequently, digital OER worksheets or textbook pages in a PDF or MS Word format could be followed by a streamed YouTube video or an interactive website that contained Java programming. To the user, there was no disruption or deviation from the learning pathway clearly indicated by the VLE navigation tools. However, should a local group decide to adjust the sequence then this is easy to achieve using the VLE's drag-and-drop functionality.

Canvas also has good assessment functionality, allowing for the construction and easy adaptation of tests. Another important characteristic required for the prototype was public access so that users could bypass the login and password screens to allow ease of access to the 'textbook'. However, when a class or group wish to manipulate the 'textbook', then Canvas offers customizable permissions that could be set up for individual staff and or students. Another piece of functionality offered by the VLE that was essential to the model was the ability to deploy copies of a master course so that different groups had their own version of the textbook to manipulate and develop.

Figure 4   Structure of the Caribbean Secondary Education Certificate (CSEC) Mathematics Algebra in the Canvas VLE

Electronic Content Repository (Drupal Database)

Alongside the VLE, but linked to it, is a content repository developed as a Drupal module. It provides functionality for the storage of electronic documents and 'tagging' of all OER. The repository stores metadata for all the OER used in the prototype, and every OER collected was described against the Caribbean Examination Council's (CXC) CSEC mathematics curriculum. This allowed student and staff developers looking to rework the 'textbook' an initial bank of existing and additional OER to peruse and consider all linked to the curriculum. The repository's search facility allowed users to search according to curriculum statements, subject topics, OER service providers and resource formats. As new resources became available, they were added to the repository.

An additional function of the repository was to provide a facility that allowed the scaling up of the 'textbook' so that it could be quickly adapted to support curricula from elsewhere. Additional curriculum taxonomies could be added and mapped against the existing taxonomy to enable linkages to appropriate OER already in the database. It is anticipated that, in time, as the 'textbook' is used elsewhere, this mapping exercise will allow staff and students globally to access the same OER for

similar purposes. In secondary school mathematics, the overlap between national curricula makes this both logistically and educationally feasible.

The repository also provided the 'textbook's' home page, containing directions on how to use the OER VLE Prototype and repository and provided a list and links to the mathematics topics. The home page also contained access to the repository's search facilities. (See http://www.caribbeanoer.org).

Figure 5   Repository Landing Page

Structure and Content

At the heart of the prototype were quality OER and a curriculum structure that provided a framework from which to understand these resources.

The CXC CSEC Curriculum Framework

The CXC CSEC Mathematics curriculum is aimed at Junior Secondary or Middle School, and covers two years of study. It contains ten mathematics topics each with its own set of specific objectives. The topics and specific objectives provided the initial structure for the OER Textbook Prototype and guided the selection of the first batch of OER.

OER Mathematics Resources

Against the structure provided by the CSEC Mathematics curriculum, a small team of content experts selected 517 OER based on whether they cover mastery of the specific objectives. There were other selection criteria, for example, that resources should:
- Be of high in quality;
- Comprise a mix of media (video, interactive components, audio and strong visual elements) to minimize text density and appeal to different learning preferences;
- Contain a mixture of 'voices' so that multiple perspectives and approaches could be presented as options for students to consider; and
- Preferably be from a Caribbean context.

The initial layout of the OER 'textbook' also took sequencing of materials as an important component of the design. OER were selected so that when experienced in order, the user would be better able to develop the skills and knowledge described by the curriculum objectives. The initial layout of the OER, however, was always considered to be a 'demonstration' of what was possible and act as a starting point for student and teacher customization. It in no way attempted to be set, fixed or protected.

Self-assessment Opportunities and Interactivity

Many of the collected OER havew built-in activities or interactivity encouraging user engagement built into the resource. However, the initial design of the prototype assumed that users should have additional opportunities to assess their progress against the curriculum objectives. For the initial deployment of the prototype, a set of ten self-assessment quizzes, one for each topic and with a minimum of one question per objective, were developed. Located at the end of each topic, these quizzes were designed as formative assessment to provide immediate feedback to the user and provide guidance even on incorrect responses. However, like the content, the tests were designed to be customized. Teachers and students could add or delete questions, reword instructions, add additional distractors, and so on. They could even add additional assessment opportunities at different stages of the mathematics topic.

Deployment Strategies

While the OER VLE platform was designed to be adapted to differing contexts, various deployment scenarios that were anticipated in the early stages.
- *Minimal Deployment Strategy (Public access / teacher reference)*
  Under this setup, the OER VLE is accessed using public or guest access to the materials. Resources can be read and interacted with, but not manipulated or changed. This deployment strategy would appeal to self-taught students desirous of quality instruction to supplement their experience at school or district. Using the OER VLE as initially designed, a student can work at their own pace through the sequenced OER using self-assessment opportunities to test their mastery of the concepts and skills. In this setup, the student uses the OER VLE very much like a regular textbook, but also benefits from interactive elements within the OER and the self-assessment opportunities that provide immediate detailed feedback. Alternatively, this simple setup can be used by new or inexperienced teachers who benefit from a source of quality teaching and learning materials, selected and vetted by a senior educator with many years of experience. These new teachers can use the materials either as a reference or as a structured environment for their lessons where they act as a facilitator or guide through the materials. The OER VLE provides a sequencing of the materials and access to varied formats that would appeal to different learning preferences.

- *Standard Deployment Strategy (Contextual repurposing by educators)*
  The standard setup requires teachers to be provided permissions to access and edit a school version of the master OER 'textbook'. Users are issued with rights that allow them to change the

textbook content and activities. The OER 'textbook' can thus be manipulated to suit local learning contexts. OER can be added to the modules, such as a teacher's own notes and worksheets, while other resources can be deleted if deemed unsuitable by the teacher. The sequence of the resources can also be changed. Also, those OER whose licensing allow repurposing, could be downloaded, adapted, and re-uploaded. In addition, teachers can add additional questions to the quizzes or even offer more opportunities for students to test themselves. The unique nature of OER and the development tools built into the VLE encouraged this repurposing, something totally absent from traditional textbooks.

- *Advanced Deployment Strategy (Students as content authors)*
  The OER 'textbook' prototype's tools and permissions also lend themselves to more student-centred teaching and learning strategies. Using exactly the same tools provided to educators in the standard setup, this deployment strategy allows students to be provided editing rights. Students can then fashion the modules in a way that makes sense to their peers using examples drawn from their collective experience. As students do not start from scratch, this allows them to quickly acquire the skill or knowledge and then consider how to adapt the module for a new audience.

Pilot Study

In March 2014, four schools in Antigua and Barbuda were identified to pilot each of the OER VLE Prototype's deployment strategies with their teachers and students. A further 22 schools were identified where the mathematics teachers would work collaboratively in a Community of Practice to determine how they might use the prototype to improve mathematics teaching. In this group the students were not directly consulted.

The pilot schools were provided a set of activities that guided them in using the prototype as a basic 'textbook', a tool that could be repurposed to support individual teaching styles, and then as an environment where students could either adapt and author their own learning materials for both themselves and their peers. In order to expedite the repurposing of the OER VLE Prototype to better suit specific needs a set of simple 'How-To' guides were developed for the students and staff (See Appendix E). The prototype at that stage also required that personnel within the ministry set VLE permissions to enable pilot students and teachers access the tools required for adding, deleting and changing the sequence of resources.

It is still too early to determine which of these strategies will be most successful in the context of Antigua and Barbuda. An assessment of the pilot study is scheduled for April, 2014 when some conclusions can be reached. During this assessment, online questionnaires and focus group discussions will be used to collect teacher, student and principal feedback in order to ascertain whether the prototype encourages any reflection on teaching and learning processes and how the prototype impacts on student mathematics performances. The feedback will also inform from a technical perspective how the prototype can be improved and expanded to better act as a tool for teaching and learning but also transformation.

Changes at a Regional Level

Antigua and Barbuda is a small nation in the Caribbean, and forms part of the larger Caribbean Community (Caricom). There are currently five key mechanisms in place that govern teaching and learning activities within the Organization of Eastern Caribbean States (OECS), all of which have been produced by the Caribbean Examinations Council (CXC). These are:

- The Caribbean Certificate of Secondary Level Competence (CCSLC), which focuses on mid-secondary cycle examinations;
- The Caribbean Secondary Examinations Certificate (CSEC), which comprises 30 subjects;
- The Caribbean Advanced Proficiency Examination (CAPE), which incorporates a growing range of subjects;
- The Associate Degree of the CXC; and
- The Caribbean Primary Exit Assessment (CPEA), which is an innovative new primary-level assessment procedure that has been used in some countries to place students at the secondary level, within a broader context of the achievement of Universal Secondary Education, from 2012.

Through these collaborations, there is further strong commitment at the level of the OECS to acquire jointly educational materials for these regional curriculum mechanisms, including – according to OESS 2012-2021 – procurement of digitized materials. A similar idea was also discussed at a Regional Caribbean OER Policy Workshop organized by the Commonwealth of Learning (COL) and UNESCO in November, 2012, which recommended, amongst other priorities, the establishment of national policies on openly licensed educational materials and the establishment of a regional OER repository.

Within this context, and building on national policy engagements facilitated by COL and UNESCO in several OECS member states during the first half of 2013, COL organized a follow-up workshop, this time focused primarily on engagement within the OECS (while also broadening involvement beyond this through the participation of a representative from Guyana). This workshop took place in Antigua & Barbuda in June, 2013. The workshop included representatives from: Antigua & Barbuda; Dominica; Grenada; Guyana; St Kitts & Nevis; St Lucia; and St Vincent & the Grenadines.

During the 23rd Meeting of OECS Ministers of Education in October 2013, Ministers endorsed the proposal to continue developing a prototype Open Textbook initiative for the OECS. The goal of this Open Textbook Prototype will be to demonstrate that OER can be cost-effectively harnessed to create comprehensive, integrated multimedia packages of content that can replace textbooks while improving student performance in the Caribbean Senior Certificate and freeing up finances for investment in more locally relevant content. Thus, the Antigua and Barbuda initiative is effectively a regional pilot activity.

They also agreed on a follow up process during this meeting which includes preparing a detailed cost breakdown, further developing a proposal in collaboration with major stakeholders such as the OECS, Ministries of Education, and CXC; and to collaborate with Notesmaster to import all of the meta-data from the OER Repository into the Notesmaster system in order to take advantage of the powerful social networking tools that are built into that platform.

These developments provide fertile ground for implementing new initiatives that have potential to drive systemic change. If the initiative in Antigua and Barbuda proves to be successful, it can thus be rapidly scaled across the nine other states in the region.

Conclusion

This research project has sought to engage with the challenge of determining the conditions under which use of OER can drive a transformative educational agenda in schooling systems, using case studies in the developing world as its action research terrain. The desktop research conducted served to reinforce the urgent imperative for transformation of traditional schooling models, which are increasingly unsuited to the world in which their students live. It also highlighted that the notion of a transformative educational agenda has a longstanding lineage, which precedes the emergence of the concept of OER by several decades. Given this, it becomes important to understand what the systemic blockages are that are impeding significant transformation and what can be done to circumvent these.

The work in both South Africa and Antigua and Barbuda has demonstrated that, at the core of the transformational challenge is the reality that the pattern of day-to-day behaviours and teacher-student interactions are very heavily circumscribed by the formal curriculum, a problem exacerbated by the heavy, and in many instances growing, emphasis on high-stakes examinations that test student success in these formal curricula. Unless key role players that hold high levels of influence in these systems – most notably, parents and teachers – can be convinced that alternative models of school organization can improve, or at least not erode, performance in these high-stakes examinations, social tolerance for any significant systemic change is likely to be negligible.

This is why OER initiatives that simply replace proprietary resources with openly licensed ones, but with no significant intention to shift the basic productivity of teacher-student interactions are so unlikely to lead to any kind of significant systemic transformation. The experiments conducted at St Peter's College have demonstrated a significantly different application of OER, one that is both significantly cheaper even than OER textbook initiatives (given the vast eco-system of OER that exists already online, once the VLE infrastructure is established, basic capacities are developed, and models can be demonstrated to work successfully, there is no major additional investment required of any kind) and that brings the added value of developing a much wider range of student competences than just subject knowledge. More importantly, though, if such approaches can gain traction, they have very significant potential to create the opportunity to reconfigure fundamentally the weekly school timetable in order to create much greater space to introduce the kinds of change planned by the College. The sustained commitment by management to these changes after the pilot demonstrates that there is growing confidence that this can be done in ways that bring all of the school's key stakeholders along with the College management and staff.

Of course, making these shifts are much easier at a single, private school than across an entire system. The work done in Antigua and Barbuda is to embryonic to claim success, but there are already many important tools emerging that might provide a roadmap for effective change. These include the following:
1) Proactive, visionary statements of policy intent;
2) Detailed strategic plans, with clear targets that work towards the achievement of the policy vision;
3) Budgetary and logistical commitments from government to ensuring that ICT infrastructure is universally applied across the whole system (systemic innovations cannot be deployed unless government can ensure equity of access to those opportunities across the whole system);
4) Strong engagement with principals and school management in planning the integration of ICT into schools, on an ongoing, annual basis;
5) Creation through prototypes of models that demonstrate the potential for OER to serve a transformative educational agenda;
6) Strong engagement and professional development to enable core groups of teacher 'champions' to lead the process of change;

7) Careful evaluation to measure the impact of changes ushered in by innovations as they are introduced.

Thus, while success is far from assured, we believe that this research demonstrates that there is both sufficient evidence of the failure of traditional schooling models to meet changing social needs and enough pointers to the kinds of systemic actions required for the proponents of OER to no longer chase after 'low hanging fruits' that simply reinforce the failed models of schooling and rather seek to build sustained pressure for long-term, educationally effective systemic change.

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Appendix A: An ICT in Education Policy for Antigua & Barbuda

Introduction

The vision of the Ministry of Education, Sports, Youth, and Gender Affairs in Antigua and Barbuda is to encourage lifelong learning and educate our citizens to access and evaluate knowledge through creative problem-solving and critical thinking in preparation for work in a dynamic national, regional and global economy.

Our mission is to ensure that all students in Antigua and Barbuda obtain the highest quality education possible from the pre-school to the post graduate level that will enable them to become good citizens who will be able to compete nationally, regionally and globally. We will work with various stakeholders in the society in order to improve and strengthen our educational, sports and youth empowerment institutions, to develop productive citizens, who can learn and work independently and cooperatively to contribute to their national, regional and global communities.

Within the framework of this vision and mission, the government of Antigua and Barbuda recognizes that knowledge-based activities have become increasingly important. It is this recognition that has prompted Government to develop the use of Information and Communication Technology (ICT) in its daily activities. There has been a thrust in training citizens to use available technology and to become more effective and efficient. Through the introduction of a new ICT in Education Policy for Antigua and Barbuda, it is the Ministry's hope to respond to the change which technology brings to the nature of work and the work place, the so-called 'Knowledge Revolution'. This is paramount for the Ministry, charged with the responsibility to educate the labour force to harness the power of ICT for continued development. We are committed to improving the teaching, learning and administrative processes in the education system with effective use of ICT and to provide all students with the basic ICT skills that are necessary for the information age.

This commitment is consistent with broader regional education policy within the Organization of Eastern Caribbean States (OECS). The *OECS Education Sector Strategy (2012 – 2021)* (or OESS) articulates a vision for a whole school curriculum that 'engages school leadership, teacher skills, knowledge and understanding, curriculum leadership, professional learning, data collection and use, sharing and transferring knowledge and good practice, and the use and application of resources and ICT in a cyclical and iterative process' (OECS, 2012). It is also consistent with the Government's current emphasis on Science Technology, Engineering, and Mathematics (STEM), with are a key pillar of national development plans in Antigua and Barbuda.

This policy replaces the previous ICT in Education Policy from July, 2003.

1.   Strategic Educational Priorities

To contextualize the rationale for integration of ICT across all levels of education in Antigua and Barbuda, the Ministry of Education, Sports, Youth, and Gender Affairs has identified the following as key strategic priorities to guide effective ICT integration into education:

1.1.   The Ministry is committed to creating globally competitive students/citizens by ensuring that all children are given an opportunity to learn and are able to develop effective competence in all relevant subjects of study.

1.2.   There is a need to provide both universal early childhood education and universal secondary education. In secondary education, special focus will be placed on enhancing both physical and intellectual access to secondary level educational opportunities

1.3.   The Government of Antigua and Barbuda is committed to creating an inclusive society to ensure that the potential of all students is realized, irrespective of physical, visual, or other challenges. This needs to be supported by establishing a functional diagnostic centre.

1.4.   Emphasis on improving learner achievement is needed with a view to:

   1.4.1.   Increasing the number and quality of passes in each subject at all grade levels;

   1.4.2.   Using authentic experiences to help student to apply content to real life experience (project- and problem based-learning); and

   1.4.3.   Placing special emphasis on at-risk students to minimize the risks of these students dropping out of schooling prematurely.

1.5.   It is essential to develop, and keep current, a standardized curriculum for all subject areas across all grade levels and to develop high-quality content standards at all levels to ensure comprehensive coverage of all aspects of this curriculum. Within this, the Ministry of Education, Sports, Youth, and Gender Affairs is committed to providing access to comprehensive, freely available sets of openly licensed resources in multiple media for use in schools.

1.6.   There is a need to restructure the education assessment processes for both educators, schools, and the overall system. This requires, amongst others:

   1.6.1.   Ongoing development and implementation of needs assessments for education in the country;

   1.6.2.   Analysis of the local market/economy in order to structure the education system in a way to meet key needs and fill gaps;

   1.6.3.   Analysis of assessments implemented that leads directly to implementation of changes in such a way that education goals and objectives are met;

   1.6.4.   Long-term commitment to introducing a suitable (and supportive) licensing system for educators.

1.7.   The Ministry of Education, Sports, Youth, and Gender Affairs wishes to develop an open culture of research and information-sharing, amongst schools, educators, and principals, as well as across the system and with the broader community. This should both facilitate transparency and enable decision-making, policy development and programme implementation that is based on good research.

The Government of Antigua and Barbuda is committed to integrating ICT into its education system in ways that directly advance these key strategic priorities. In order to do this, it has identified a number of key policy commitments, presented below. These will then be implemented systematically through a rolling Strategic ICT in Education Master Plan.

2.   Infrastructure and Connectivity

Through the Ministry of Telecommunications, Science and Technology, extensive ICT infrastructure has been supplied to the schooling system, including Community Computer Access Centres (CACs), Mobile IT Classrooms, the one-laptop-per-teacher initiative, tablets for senior secondary students, and widespread, free Internet access. Thus, the primary policy focus of the Ministry of Education, Sports, Youth, and Gender Affairs is to ensure optimal use, care, maintenance, timely replacement, and environmentally responsible disposal of this ICT infrastructure. From this perspective, the following policy commitments are noted:

2.1.   Connectivity and Internet access will be expanded and improved across the education system on an ongoing basis, with a particular focus on widening access to include classrooms (through wireless hotspots) and the Ministry of Education headquarters.

2.2.   The Ministry of Telecommunications, Science and Technology will provide the necessary hosting infrastructure for key systems through its data centre. These systems will include a central Education Management Information System (EMIS), a Learning Management System (LMS) to be used in supporting school learning, an open educational resource (OER) repository, and appropriate communication and social networking tools to facilitate interaction between key education stakeholders within Antigua and Barbuda

2.3.   Steps will be taken to ensure classroom safety, health, and security across schools. This will include:

2.3.1.   Development of an infrastructural standard for all classrooms;

2.3.2.   Improvement of basic infrastructure at the classroom level, including cable connections for wireless networks, electrical outlets, physical security facilities where necessary, and flexible furnishing arrangements to enable use of ICT in a wide range of educationally innovative and varied ways.

2.3.3.   Development of a suitable, environmentally responsible ICT replacement and e-waste disposal policy.

2.4.   To ensure the optimal use of currently available ICT resources within the education system, the Ministry of Education will encourage greater local ownership and accountability from all schools by requiring them to develop an annual ICT Integration Plan. This will include

2.4.1.   A long-term vision for use of ICT in the institutions;

2.4.2.   Codes of conduct for ICT usage by students, educators, institutional management and administration, and the wider community;

2.4.3.   Curriculum policies outlining how the institution intends to use ICT to support teaching across grades (or programmes) and learning areas/subjects;

2.4.4.   A detailed list of technology and bandwidth requirements;

2.4.5.   Timetables outlining how the ICT resource will be integrated into the educational day, and what levels of access will be made available to which groups of learners;

2.4.6.   Clear policies on extended afternoon, weekend, and school holiday use of ICT, accompanied by plans to provide incentives to educators to enable this extended use;

2.4.7.   Policies on community use of ICT;

2.4.8.   Strategies to acquire further ICT as appropriate;

2.4.9.   Professional development strategies;

2.4.10.   Strategies to cover operating costs of ICT, including an annual budget;

2.4.11.   Defined roles for ICT coordinators and their backups;

2.4.12.   Guidelines on ICT application and educational content acquisition; and

2.4.13.   Strategies for monitoring and evaluation.

2.5.   All schools in Antigua and Barbuda will be expected to have such plans in place, and these will be updated and submitted annually as part of broader yearly school planning exercises. All acquisition of new infrastructure will need to be linked to effective use of already available infrastructure. Development of these plans will be coordinated by the Ministry at a national level, with guidance of the ICT in Education Steering Committee (see item 7 below) and inclusion of the ICT Teachers' Association and all school principals.

2.6.   All plans will be reviewed upon the submission to the Ministry in order to ensure that they are realistic and to enable monitoring to determine relative success by schools in achieving set goals. This review process will be used as a basis for future resource allocations by the Ministry.

2.7.   Clear codes of conducts on the use of computers and related devices, for all users (including Ministry officials, principals, educators, and students) will be developed and compliance ensured on an ongoing basis (both through school plans and national monitoring and evaluation strategies).

2.8.   Current human resources for the maintenance of ICT infrastructure will be re-organized to streamline maintenance of ICT equipment. The following is noted in this regard:

2.8.1.   A national infrastructure management plan will be developed and updated annually.

2.8.2.   The Ministry of Telecommunications, Science and Technology will focus on connectivity, network, and central systems hosting.

2.8.3.   A Dedicated ICT Maintenance Unit will be established within the Ministry of Education, Sports, Youth, and Gender Affairs, under the portfolio of the ICT Coordinator but also forming part of the Board of Education Maintenance Unit.

2.8.4.   A structured focus will be placed on integrating school ICT Coordinators and students into maintenance systems to increase maintenance capacity and offer students grounded learning opportunities.

3.   Teaching and Learning

The Ministry of Education, Sports, Youth, and Gender Affairs has, embedded in its vision and mission statements, a strong commitment to upgrading its curriculum to help students to develop skills that will enable them to succeed in the new knowledge economy. Experience worldwide indicates that ICT can play a key role in transformation of education. ICT can enhance educational reform by enabling educators and students to move away from traditional approaches to teaching and learning. In this

transformed teaching and learning environment, there will be a shift from teacher-centred, task-orientated and memory-based education (with technology at the periphery), to an inclusive and integrated practice where learners work collaboratively, develop shared practices, engage in meaningful contexts, and develop creative thinking and problem-solving skills (there are several initiatives that promote these kinds of shift already underway and demonstrating good results). With this in mind, the Government of Antigua and Barbuda notes the following policy commitments:

3.1.   There will be ongoing review and revision of the national curriculum at all levels, with strong emphasis placed on adjusting assessment strategies to assess wider range of competences rather than just content recall. In this process, specific account will be taken of the ways in which ICT can, when used effectively, be harnessed to enable different kinds of teaching, support, and assessment. The objective will be to engage students in higher order thinking such as analysis and synthesis that is beyond simple recall or memorization, which encompasses thinking processes such as critical thinking and problem solving, and that results in active construction of new knowledge.

3.2.   ICT will be harnessed, particularly at the secondary level, to enable more effective use of face-to-face interaction at schools, so that teachers are both empowered and provided the necessary time to shift their focus away from teaching content to supporting and mentoring students who work in increasingly diverse and flexible ways (including self-paced study using ICT infrastructure supplied by Government) during the school day.

3.3.   Building on the previous commitment, the Ministry will seek to harness both technology and self-paced learning to enable at-risk students to keep pace with the curriculum and to introduce more flexible support systems during the school day, thus engaging these students in solving their educational challenges before they drop out of the system prematurely. Emphasis will also be placed on how ICT can be used to assist to develop skills that will assist students to create employment for themselves (through suitable forms of entrepreneurship).

3.4.   The Ministry of Education, Sports, Youth, and Gender Affairs will develop a repository of openly licensed resources, with a view to ensuring that all students in the country have free and open access to openly licensed resources of multiple media that are sufficiently comprehensive to enable them to successfully meet the requirements of the regional and national curriculum frameworks governing education in Antigua and Barbuda. It will seek to develop this national repository in partnership with other OECS states, so that it forms part of a wider regional repository of openly licensed content. This repository will include:

    3.4.1.   Clear criteria for the assessment of educational resources, with a heavy emphasis on access to authentic tools and resources that reflect real-life experiences, through project- and problem-based learning;

    3.4.2.   Facilities to enable users both to rate the quality of resources (to encourage community-owned quality assurance), to conduct peer review (to ensure quality), and to upload their own resources;

    3.4.3.   Guidance to users in accessing online materials (OER, educational sites, web links, video materials, and so on);

    3.4.4.   Facilities for students to set up or join peer support groups and for educators to set up or join professional communities of practice within Antigua and Barbuda.

3.5.   The Ministry of Education, Sports, Youth, and Gender Affairs harness suitable ICT tools and software to support its goal of providing universal access to high quality education at all levels, commencing from the early childhood level.

3.6.	Likewise, The Ministry will prioritize the procurement of assistive technologies for students with special educational needs.

## 4.	Licensing

Given the strong commitment articulated to use of OER above, the Government of Antigua and Barbuda is committed to opening access to educational materials produced in the country. Consequently, the following policy commitments will pertain to government investments in educational materials, all within the framework of the Copyright Act No. 22 of 2003:

4.1.	All educational materials produced with Government funds – including both research resources and teaching and learning resources – will be released under a suitable Creative Commons licence, to facilitate their use, electronic sharing, and adaptation by others. This will include resources of all media types, including print/text, audio, video, and computer-based multimedia.

4.2.	The Ministry of Education will adopt, as a default licence for all products produced through government funding, a Creative Commons (Attribution) licence. Likewise, it will encourage all development agencies and foundations operating in Antigua and Barbuda to adopt a similar licence for all materials produced with development aid. In any cases where another licence is not explicitly mentioned, this default licence will be applied to any materials produced with government funds.

4.3.	Authors of works produced with government funds will be entitled to apply additional licence restrictions from the Creative Commons licence framework if desired, but will then need to make this explicit by inserting chosen licence in materials they have developed.

4.4.	Where a case can be made for commercial exploitation of resources, authors or institutions will be entitled to insert a traditional, All-Rights Reserved Copyright licence, but only after submission of a justification for this restriction have been supplied to the specific agency funding the work and approval having been granted for this in writing by the agency in question.

4.5.	To facilitate sharing of its materials, the Ministry of Education will work to ensure that every document released for distribution via the Internet (through its national repository) will indicate the licensing conditions of the resources clearly on the resource itself, using properly marked, machine-readable Creative Commons licences.

4.6.	Responsibility will reside with authors of works to ensure that any third-party materials incorporated in resources produced with government funds do not breach any relevant copyright laws, either nationally or globally.

## 5.	Management and Administration

To support more effective management and administration of education in Antigua and Barbuda, the Government notes the following specific policy commitments:

5.1.	An online, multi-level Education Management Information System (EMIS) will be developed and deployed online to measure and track outcomes at the class, school, zone, and Ministry level (with data accessible to multiple ministries and external agencies requiring data from the Ministry on a regular basis). The EMIS will include management tools at school level to facilitate day-to-day management of schools and automated uploading of data into the central EMIS. The EMIS will be used to measure the effectiveness of instruction and student learning, curriculum implementation, and guide modifications. It is noted that this will require

continuous training of data handlers to analyse information and generate necessary reports that can be used by decision-makers across the system to assist in development of new policies and other key strategic decisions.

5.2.   The Ministry of Education, Sports, Youth, and Gender Affairs will focus on enhancing administrative use of ICT by individuals, by using current infrastructure more efficiently. To this end, it will complete an annual exercise to review and enhance the effectiveness of the ICT Systems in place with a view to continuously improving management and administrative functions.

6.   Human Resources

The Government of Antigua and Barbuda is committed to developing and implementing a comprehensive and relevant framework that will continuously train and empower key stakeholders in education and ICT while expanding their core competences. These stakeholders include Ministry of Education officials, school principals and management teams, administrators, teacher educators, educators at all levels, students, parents, and the general public.
Given these needs, the following policy commitments are noted:

6.1.   The UNESCO ICT Competency Framework for Teachers (CFT) will be adopted in Antigua and Barbuda to guide all professional development of educators in the Country. The ICT CFT creates a common core syllabus that can be used to develop learning materials sharable at a global level, provides a basic set of qualifications that allows educators to integrate ICT into their teaching; extends educators' professional development so as to advance their skills in pedagogy, collaboration, and school innovation using ICT, and harmonizes different views and vocabulary regarding the uses of ICT in teacher education.

6.2.   Professional development of teachers will focus on all teachers to ensure effective ICT use from the early childhood level. Furthermore, the ICT CFT will be used as a framework to govern both pre-service training and continuing professional development (CPD), to ensure that there are pathways for ongoing capacity building and refresher courses.

6.3.   It is important to determine initial training and continuous professional development (CPD) needs for all key stakeholders, while providing them with the necessary resources and opportunities to meet their educational needs. Consequently, a baseline audit of competence will be repeated annually to establish competency levels amongst all key stakeholders, as well as to monitor developments in competence over time.

6.4.   Using the UNESCO ICT CFT, the Ministry of Education, Sports, Youth, and Gender Affairs will seek to align and integrate all relevant current professional development courses in the country into a broader national framework of competence. This will include courses offered by the University of the West Indies, the Ministry itself (through the Teacher Education Department and Curriculum Development Unit), and other support agencies such as the Commonwealth of Learning. Where necessary, existing courses will be reviewed to ensure alignment with the UNESCO ICT CFT.

6.5.   The Ministry will work with the Commonwealth of Learning to incorporate ongoing use of the Commonwealth Certificate for Teacher ICT Integration (CCTI) in Antigua and Barbuda. This Advanced Certificate in Education will primarily be aimed at teacher educators initially, although it will also be made available for enrolment by any interested teachers.

6.6.   As has been noted, strong emphasis will be placed on developing a sense of ICT ownership amongst school principals by supporting the development, implementation, and monitoring

of school ICT Integration Plans. To this end, a rolling series of professional development activities, including development of an agreed national template for ICT Integration Plans, will be implemented to support school principals in this work.

6.7.   Courses and modules developed in Antigua and Barbuda will build on and adapt existing national and international courses and modules wherever possible, in order to reduce the costs of development and to improve the quality of the courses offered. Extending the principle of harnessing existing content, the Ministry of Education will also facilitate sharing of all courses/modules and associated educational materials by releasing them under an appropriate Creative Commons (CC) licence, so that they are openly accessible and shareable between key participating institutions, as well as being accessible to all schools in Antigua and Barbuda and to the broader OECS education community.

6.8.   Professional learning communities and fora will be established through the national content repository to facilitate sharing of best practices and resources amongst educators and other key stakeholders.

6.9.   Ensure contractually binding commitments in order to achieve objectives – needs to be linked to adjusted expectations of how time is used during working days to create space for new functions without leading to overload. These commitments should be underpinned by a requirement to engage in continuous professional development opportunities as part of their annual programmes of work.

6.10. Extensive collaboration is envisaged between stakeholders, the private sector, and public sector to provide assistance in training, infrastructure, and information sharing. A range of interventions will be required for all stakeholders: courses, workshops, conferences, self-study materials, and other forms of professional development. The initial focus in developing courses for educators will be to make available training activities that bring all educators in the country to the 'Knowledge Deepening' level on the UNESCO ICT CFT.

7.   Governance

In operationalizing this policy, it is essential to facilitate collaboration between government Ministries, most notably between the Ministry of Education, Sports, Youth, and Gender Affairs and the Ministry of Telecommunications, Science and Technology, but also involving other government ministries as appropriate. Ongoing discussion is essential between Ministries during planning stages of ICT in education to ensure more effective and sustainable implementation.

7.1.   It is noted that:

7.1.1.   The Ministry of Telecommunications, Science and Technology will be responsible for ICT infrastructure (connectivity and networking) nationally, including provision of server and hosting infrastructure for centralized platforms (including a content repository, EMIS, learning management system, and suitable social networking tools);

7.1.2.   The Ministry of Education, Sports, Youth, and Gender Affairs (through the Board of Education) will be responsible for installation and maintenance of equipment in schools, development of curriculum and content, and the training of principals and educators;

7.1.3.   All Education Officers, and particularly Curriculum Officers, within the Ministry of Education, Sports, Youth, and Gender Affairs will provide support to schools through

mentoring/coaching and making available opportunities for professional development; and

7.1.4. The Department of Teacher Education will be responsible for coordinating training and re-training of teachers in alignment with this ICT in Education Policy and in partnership with other key agencies as appropriate.

7.2. An inter-Ministerial ICT in Education Steering Committee will be established, which comprises: the Minister of Education, Sports, Youth, and Gender Affairs (as Chair), the Minister of Telecommunications, Science, and Technology, the Minister of Finance and Information, the Permanent Secretary of the Ministry of Education; the Director of Education; the Head of the Department of Teacher Education; the Head of the Curriculum Development Unit; at least one high-level representative from each of the Ministry of Telecommunications, Science, and Technology and the Ministry of Finance and Information (to act as advisors to their respective Ministers); a representative of the Antigua and Barbuda Union of Teachers (ABUT); a representative of the National Parent Teacher Association (NPTA); one representative from the private sector; and the ICT in Education Programme Manager (ex officio).

7.3. The Steering Committee will meet at least once every six months, but meetings will also be scheduled around key milestones and key decision points.

7.4. The Steering Committee will have the following Terms of Reference:

7.4.1. Maintain ownership of the policy and oversight of implementation of all projects falling under the framework of the policy;

7.4.2. Manage and monitor a strategic ICT Integration Implementation Plan flowing from the policy, using a coherent and structured review of successes and failures to guide continuous improvement;

7.4.3. Provide final approval of project plans, ensuring that project deliverables align with the requirements of the policy and key stakeholders;

7.4.4. Approve the structure and governance of sub-committees of the Steering Committee (with three proposed sub-committees to be Infrastructure, ICT Integration and Content, and Capacity Building);

7.4.5. Approve and monitor expenditure on ICT in education;

7.4.6. Consider any strategic issues that have implications for the ICT in Education Policy and Strategic Implementation Plan

7.4.7. Resolve conflicting priorities or opinions of stakeholders to ensure consensus

8. Monitoring and Evaluation

8.1. A detailed monitoring framework will be developed to collate activities at individual schools and so track and measure progress made towards a defined set of national targets (to be included and updated annually in a Master ICT in Education Plan. This will be developed collaboratively and includes:

8.1.1. Mechanisms to measure quantitative factors such as resource allocations, student: device ratios (through suitable inventories and electronic tracking of equipment),

numbers of educators trained, schools that are e-ready, schools that have ICT, learner performance and attendance, and web use statistics;

8.1.2. Mechanisms to measure qualitative changes such as learner and teacher attitudes to work; student achievement; perceptions to the value of interventions; new approaches to and responses regarding teaching learning administration and communication; and

8.1.3. Baseline data pertaining to school e-readiness.

8.2. The above monitoring system will be integrating into the national EMIS to facilitate capturing and analysis of data, as well as use of this monitoring data in relevant decision-making processes. Emphasis will be placed on open access to this EMIS data, as well as on providing timely feedback and recommendations required from ongoing analysis; aimed at students, teachers, and schools, with a strong focus on mentoring and support rather than top-down supervision.

8.3. Clearly defined research or evaluation projects or studies will be commissioned to investigate specific issues within the national policy, on an ongoing basis as funds allow. These may involve longitudinal tracking, deep case study reflection; collation of successes and failures within the system; and analysis of international trends or international approaches. This research and evaluation focus will be integrated into a broader STEM research agenda within Antigua and Barbuda, in line with Government's National Development Planning priorities.

Appendix B:
An ICT in Education Master Plan for Antigua and Barbuda (2014 – 2016)

1 Introduction

On 18th June 2013, the Cabinet of the Government of Antigua and Barbuda approved a new policy on Information and Communication Technology (ICT) in education. That document identifies a number of key policy commitments in different areas associated with ICT integration in education. This ICT in Education Master Plan accompanies that policy, and defines clear implementation targets for the period from 2014 to 2016, together with detailed operational plans to achieve the targets defined for 2014.

2 Key Targets

Initial targets for ICT in education are presented below.

Table 5   Key ICT in education targets

Area	Target	By 2014:	By 2015:	By 2016:
Infrastructure & Connectivity	46) Is a database in place that monitors the status of infrastructure and connectivity rollout into educational institutions in Antigua & Barbuda?	Yes	Yes	Yes, integrated into EMIS
	47) Percentage of institutions having any level of Internet connectivity.	75%	100%	100%
	48) Percentage of schools connected at minimum speed of 10 mbps.	30%	65%	100%
	49) Percentage of schools connected at minimum speed of 35 mbps.	5%	25%	50%
	50) Is adequate server and hosting infrastructure and bandwidth in place within the Ministry server environment to host key systems effectively (EMIS, LMS, OER Repository, Ministry website)?	Yes	Yes	Yes
	51) % of all schools (including Antigua State College and Antigua & Barbuda International Institute of Technology) that have adopted an approved ICT in education plan	25%	50%	75%
	52) % of all schools that have revised and updated an approved ICT in education plan	0%	25%	50%
	53) Is a Diagnostic Centre for students with special educational needs operational with all of the technology that it requires?	ICT Integration Plan developed	Yes	Yes

Area	Target	By 2014:	By 2015:	By 2016:
	54) Has an ICT infrastructural standard for schools and school classrooms been developed?	Yes	Yes	Yes (updated)
	55) Percentage of schools that have access to the basic infrastructure required to integrate ICT into their operations:			
	a) Some form of transport access (of sufficiently good quality to guarantee safe and reliable delivery of sensitive ICT equipment).	100%	100%	100%
	b) Safe and secure building infrastructure that conforms to requirements of building standard.	50%	75%	100%
	c) Reliable and stable provision of electricity from a range of appropriate sources.	70%	90%	100%
	d) Telecommunications access, enabling Internet connections.	90%	100%	100%
	56) Percentage of the schools (including ASC and ABIIT) submitting annual ICT Integration Plans, that are equipped with all of the technology solutions that they require in terms of their ICT Integration Plans:	10%	25%	50%
	57) Percentage of teachers, school principals, and school administrators who have their own laptop and access to connectivity through school and/or home	90%	100%	100%
	58) Percentage of Grade 10 and 11 students who have their own tablet device and LTE Connectivity	100%	100%	100%
	59) Percentage of administrators and managers having and using their own e-mail address	50%	100%	100%
	60) Percentage of educators having and using their own e-mail address	50%	100%	100%
Teaching and Learning (including content licensing)	61) Is government policy on intellectual property updated to reflect a commitment to open licensing for government-funded projects?	No	Yes	Yes
	62) Is a national content repository for school content in place?	Yes, integrated into OECS	Yes, with access to curriculum-aligned OER	Yes, with complete CXC coverage
	63) Are government materials online and accessible under an open licence?	Audit of available government materials complete and materials released under CC licence	All newly produced government materials shared under CC licence	All newly produced government materials shared under CC licence

Area	Target	By 2014:	By 2015:	By 2016:
	64) Is a rolling list of content development priorities developed and key content priorities being produced?	Yes	Yes	Yes
	65) Has the MoESYG developed a national set of criteria and tools for evaluating different educational content products?	Yes	Yes	Yes
Management and Administration	66) Is a national EMIS system in place, which is used effectively and meets MoESYG requirements (including pre-schools)?	Yes (excluding pre-schools)	Yes, with pilot for 3 govt pre-schools	Yes
	67) Is an HR Information System operational that covers all educational personnel in Antigua and Barbuda?	Design completed	Yes	Yes, integrated with EMIS
	68) Percentage of schools using ICT applications for the following purposes:			
	a) Management and administration;	50%	100%	100%
	b) Electronic submission of EMIS data;	50%	100%	100%
	c) Communication;	100%	100%	100%
	d) Access to information; and	50%	100%	100%
	e) Teaching and learning.	25%	50%	100%
	69) % schools covered by Student Support Technician Clubs (SSTCs) as primary maintenance and support system	25%	75%	100%
Human Resources	70) UNESCO ICT Competency Framework for Teachers (CFT) adopted in Antigua and Barbuda, with accompanying framework for school principals and administrators	Yes	Yes	Yes
	71) ICT CFT modules (Technology Literacy and Knowledge Deepening) integrated into Associate Degree and Diploma in Education at ASC	No	Yes	Yes
	72) ICT CFT modules (Technology Literacy and Knowledge Deepening) available for delivery as part of in-service teacher training	Technology Literacy only	Yes	Yes
	73) People enrolled in CCTI	50	50	50
	74) Teachers enrolled in ICT CFT in-service modules	100 – TL 0 – KD	150 – TL 100 – KD	200 – TL 150 – KD
	75) Is a training course for school principals on school ICT integration developed?	No	Yes	Yes
	76) Percentage of school principals who have completed training	0%	50%	100%
	77) Is a suitable training course for teacher educators at Teacher Education Department identified?	Yes	Yes	Yes
	78) Percentage of teacher educators who complete a suitable training activity tailored to their professional development needs	100%	100%	100%
	79) Percentage of all educational role-players (including government officials, school principals and management teams, administrators, teacher educators, educators at all levels) possessing the skills and competence	25%	50%	75%

Area	Target	By 2014:	By 2015:	By 2016:
	required to use ICT effectively in their daily lives.			
	80) Percentage of educators using ICT for their administrative and management tasks	50%	75%	100%
	81) Percentage of educators using ICT to directly support teaching and learning	25%	60%	90%
	82) Percentage of educators participating in collaborative collegial networks	15%	30%	60%
Governance	83) Is an e-waste policy approved?	Draft submitted to OECS	Policy approved	OECS facilities operational
	84) The percentage of MoESYG taskforce that makes use of e-administration	75%	100%	100%
	85) ICT in Education Steering Committee operational and meeting regularly	Yes	Yes	Yes
	86) Has the MoESYG developed a change management strategy to support the integration of ICT into schooling and the education system, in line with the requirements of the policy?	Yes	Yes	Yes
	87) Percentage of educational role players that receive or are involved in events or processes that support the change management strategy at least three times per year (including but not limited to messages communicated to them about ICT; newsletters; conferences; workshops; roadshows etc)	50%	100%	100%
Monitoring and Evaluation	88) Has the MoESYG developed and implemented the following frameworks:			
	a) Monitoring framework?	Yes	Yes	Yes
	b) Evaluation framework?	Yes	Yes	Yes
	c) Research framework?	Yes	Yes	Yes
	89) Is an annual baseline of ICT infrastructure, ICT use, and human resource capacity being undertaken?	Yes	Yes	Yes
	90) Percentage of budget dedicated to ICT integration used for monitoring, evaluation and research relevant to the integration of ICTs in schools:	0.5%	1%	1.5%

3 Results for 2014

With clear targets for the next three years defined, the ICT Master Plan focuses next on detailed definition of deliverables for 2014. This is presented using the same categories as the targets defined above.

3.1 Infrastructure and Connectivity

Rationale/Description	Tasks	Resources Needed	Key Assumptions
1) *Database of ICT infrastructure and connectivity status at schools*			
To plan effectively, it is necessary to know what the current status of ICT infrastructure in schools is, so that future investments can be driven by accurate data. This information will be gleaned from ICT Integration Plans submitted by schools (see Result 3 below). Ultimately this database will be integrated into the national EMIS, but it will be maintained as a stand-alone database for 2014 and 2015.	• Finalize ICT Integration Plan template and collect data from schools (see Result 3 below) • Design database based on parameters of template • Input school data from ICT Integration Plans • Produce annual report on ICT Infrastructure status in schools	• Personnel to assist with data collection and capture • Possible travel funds to collect Plans where needed • Database development expert (MS Access)	• School principals will buy into rationale for developing and submitting ICT Integration Plans • Schools will submit ICT Integration Plans • Posts defined for KMU will be allocated to provide necessary personnel
2) *Two Servers installed at Parliament Building and successfully hosting Educational Management Information System (EMIS), Learning Management System (LMS), and OER Repository*			
With support from COL, an integrated OER Repository and LMS is being developed and will be ready for deployment before the end of 2013. Servers are needed to host these open source applications. Furthermore, the national EMIS is hosted in the USA, which creates problems in securing national data, as well as ensuring data integrity. This is highly problematic, and hosting needs to be localized within a secure government server environment as a matter of urgency.	• Procure and set up two servers at Parliament building, one for the EMIS and one for the LMS/repository. • Negotiate contract for migration and maintenance of EMIS on government servers with current service provider • Install OER Repository and LMS on government servers	• Two servers, appropriately configured to enable installation of platforms • Finances to purchase licence to host EMIS nationally and to enter into maintenance contract • Local database/web administrator (within KMU)	• Service provider remains willing to allow local hosting of EMIS • Skills exist locally to manage installations of each software application
3) *Approved annual ICT Integration Plans submitted by 25% of schools, as well as by ASC and ABIIT*			
The Policy Statement makes it clear that procurement of technology should be driven by school plans, which articulate clearly schools' educational objectives regarding ICT integration, documents their ICT infrastructure, and specifies their future requirements. All future procurement should be driven by these plans, so (a) requiring that all school produce such plans and (b) supporting them to complete them accurately is a high priority. A draft template for school plans has already been produced and presented to principals, so the challenge now is to ensure that schools develop suitable plans. Annual completion of these plans will form an essential process of ongoing monitoring.	• Pilot template at a small selection of schools to finalize design • Set up mailing list to communicate with all schools • Distribute plan, together with Policy Statement, and set deadline for completion • When first plans come in, complete analysis to extract clear set of priorities • Post all plans, with permission of principals, on OER repository to create culture of sharing of plans	• Personnel to assist with data collection and capture • Possible travel funds to collect Plans where needed	• MOESYG will send clear messages to all school principals regarding importance of completing plans • School principals will buy into rationale for developing and submitting ICT Integration Plans • Schools will submit ICT Integration Plans

Rationale/Description	Tasks	Resources Needed	Key Assumptions
	• Develop exclusion list of schools that have not submitted and follow up systematically to determine reasons for non-submission (aiming to achieve as comprehensive a set of submissions as possible) • Develop summary analysis of results flowing from individual school plans		• Data in plans will be used to inform future budgeting and procurement processes
4) ICT infrastructural standard for schools and classrooms developed and approved			
While ICT infrastructure is a key priority, so too is it essential to ensure that school buildings are upgraded to enable hosting of ICT infrastructure. This would include, as appropriate, installation of physical security features, stable electricity supply and plug points, Internet access points, etc. To ensure that this is done consistently, it is first necessary to develop a set of standards for different kinds of buildings within schools.	• In consultation with relevant players (principals, physical infrastructure agency, Ministry of Public Works, Board of Education, etc.), develop draft set of standards • Circulate standards widely to elicit feedback • Submit standards to ICT Steering Committee for review and approval • After approval, post standards on MOESYG Website	• N/A	• Standards will underpin future construction and upgrading of school buildings
5) Budget mechanism established to fund ICT procurement, maintenance, and replacement requirements documented in school ICT Integration Plans			
Currently, ICT procurement is largely ad hoc and based on once-off projects. This creates problems in continuity of investments and severely limits the effectiveness of these investments. Consequently, there is a need to put in place a mechanism that will enable regular annual investments in ICT, driven by needs identified in school plans. This budget mechanism should include clear limits defining allowable expenditure and should define annual priorities, based on a rolling version of this Master Plan.	• Hold meetings with Board of Education, Ministry of Finance, other relevant Ministries, and within MOESYG to agree parameters of a suitable budget mechanism to fund ICT procurement, maintenance, and replacement requirements • Complete necessary negotiations to finalize budget mechanism, to be governed by ICT Steering Committee • Include provisions for funding budget mechanism in 2015 annual budget, with budgetary amounts compiled from a prioritized aggregation of school ICT Integration Plan requirements	• Regular annual budgetary provision for ICT in MOESYG budget • KMU personnel to administer budget mechanism (as per current Ministry organogram)	• There is political commitment to investing in ICT in education • Establishment of a budget mechanism, driven by school-identified priorities, will supersede other ICT spending plans in education, thus consolidating and focusing future investments
6) 100% of educators, school principals, and school administrators have functional laptop computers and email addresses			
Although a once-off project was implemented through the EDU 2020 Initiative, there are currently no plans to ensure that this is sustained. Consequently, new teachers entering the system do not have their own laptops, while there are no clear maintenance	• Through school ICT Integration Plans, assess current status of laptop distribution (i.e. number of teachers without laptops and number of non-functioning laptops)	• Finances to procure and service laptops as necessary (estimated that 75 new laptops are	• Schools will submit ICT Integration Plans •

Rationale/Description	Tasks	Resources Needed	Key Assumptions
plans in place to ensure that these laptops are operational. This severely limits the effectiveness of the initial distribution as assumptions about teacher access to computers can no longer be assumed. Thus, it is essential that plans be established to ensure that all educators, principals, and school administrators have a properly functional laptop and email address for work purposes.	• Define budgetary requirement to purchase, replace, and/or service laptops • Secure finances to ensure 100% access to laptops for all personnel • Based on experience, define procurement requirements for devices that will ensure longevity (robustness, energy efficiency, etc) • Procure new devices and service existing devices as per defined needs • Incorporate rolling plans to sustain laptop distribution through budget mechanism established in Result 5 above)	required and 100 laptops require servicing)	
7) Plan developed to sustain rollout of tablet devices to Grade 10 and 11 students			
Although the distribution of tablet devices is ongoing, it is unclear how long there is commitment to sustaining this project. This makes future planning at school level difficult, and undermines the effectiveness of the initiative. To work successfully, the initiative needs to be underpinned by clear educational objectives and incorporated into school ICT Integration Plans. However, ongoing investment should be accompanied by research that determines whether or not the initiative is having sufficient educational impact to justify sustaining.	• Through a consultative process, define clearly the anticipated educational goals of the Tablet Initiative, which includes inputs from principals, teachers, parents, and students • Develop a detailed impact evaluation plan to measure whether or not the goals of the Initiative are being achieved • Establish a clear commitment to sustaining the Tablet Initiative until at least 2016 to enable sufficient analysis of its effectiveness • Set up a suitable insurance mechanism to ensure that all Grade 10 and 11 students are able to access tablets without undue financial risk on the part of poor parents	• Funds for impact evaluation • Funding commitment to Tablet Initiative through to 2016 • Underwriting of insurance mechanism (but mechanism itself to be funded by parent contributions)	• There is political commitment to sustain the Tablet Initiative for the next 3 years • Agreement can be reached on common educational objectives for the Initiative • Parents will be willing to pay the necessary insurance to secure tablets for their children and the amount required to be paid will be sufficiently modest to enable *all* students to access devices

3.2 Teaching and Learning (including content licensing)

Rationale/Description	Tasks	Resources Needed	Key Assumptions
8) Review of government policy on intellectual property completed to determine changes required to effect open licensing environment and draft adjustments made to policies			

Rationale/Description	Tasks	Resources Needed	Key Assumptions
Given the commitment in the ICT in Education policy to ensuring that all government-funded educational materials are released under a Creative Commons licence, it is important to undertake further review of policies and legislation in Antigua and Barbuda to ensure that this policy position is consistent with other policies and legislation. Where it is not, some adjustments to other policies may be needed.	• Identify all policies that might influence release of educational materials under open licences and conduct a full review • Prepare a report outlining any potential inconsistencies • Propose alternative formulations, where appropriate, to ensure policy consistency • Submit draft policies for review and approval	• Technical assistance in conducting policy review	• There is political commitment to ensuring release of government-funded materials under a Creative Commons licence
9) All available government-funded educational materials (including materials from Health, Agriculture, etc) released through OER repository			
Given the development of an OER Repository and commitment to sharing government-funded materials under a Creative Commons licence, it is important to identify and collect all materials that can potentially be released, verify their copyright status, and then release them through the OER Repository under an open licence. This will serve to widen access to locally produced educational resources.	• Conduct a cataloguing exercise to identify all government-funded educational materials, within the MOESYG, as well as other key Ministries, such as Health and Agriculture • Verify copyright status to ensure that government has the right to modify licences • Release all materials for which government holds copyright under a suitable Creative Commons licence, via the OER Repository	• N/A	• Posts defined for KMU will be allocated to provide necessary personnel • Other government Ministries will be willing to share their educational materials for wider use
10) Rolling list of content development priorities prepared and initial resources produced			
As part of the process of developing and launching an OER Repository, it is important to place some emphasis on producing local materials in key areas of need, rather than relying exclusively on content produced in other parts of the world. Thus, a rolling programme of content development, based on priorities identified by MOESYG officials is a high priority.	• Generate initial list of content development priorities, drawing on information from key teachers and MOESYG officials (see following section) • Negotiate with ICT Cadet's Programme to incorporate development of materials as part of that programme • Source additional funds to invest in content development and commission content development tasks as funds allow • Produce materials according to list of priorities defined • Upload all produced content onto OER repository • Update list of priority content development areas annually	• Funds for content development	• ICT Cadets will be available to support content development • Board of Education will invest in content development • Content development will focus on producing content in areas where international content is not openly available
11) MOESYG website overhauled and integrated with OER Repository			

Rationale/Description	Tasks	Resources Needed	Key Assumptions
As the OER Repository is developed, it is important that it is integrated with the MOESYG website. This provides an excellent opportunity to overhaul that website, as aspects of it have become quite dated and there is need to update the content on the site. This will also provide an opportunity to ensure that the MOESYG has direct access to the tools to be able to keep the site up to date.	• Decide whether to retain current website platform or migrate website to OER Repository content management system • Agree on priority developments required for new website • Produce new content for site to bring it up to date • Integrate site with OER Repository • Train MOESYG officials to maintain site	• Personnel to produce content • Technical experts to support overhaul process • Personnel to assist with data collection and capture	• MOESYG site can migrate to Parliament Building servers • Permission can be secured to maintain website directly

3.3 Management and Administration

Rationale/Description	Tasks	Resources Needed	Key Assumptions
12) *All secondary schools required to submit data online to national EMIS (including electronic imports of data for private schools using different MIS systems), with 100% compliance*			
13) *All primary schools encouraged to submit data online to national EMIS (including electronic imports of data for private schools using different MIS systems), with at least 10 contributing data this way*			
Given that government has invested in an EMIS, it is now important to ensure that all schools are required to submit their information through that system, as this will generate significant efficiencies. It is proposed that private schools using other MISs be entitled to submit data in an agreed format to the national EMIS, rather than being required to use the national EMIS for internal administrative purposes. The process will staff by making online submission a requirement for secondary schools, extending to primary schools in 2015 (although all primary schools will be encouraged to begin using the system sooner).	• Work with EMIS service provider to define suitable data schema to facilitate importing of data from other systems and make available to all schools using other systems (with accompanying requirement to align their systems to the standard by end of 2014) • Communicate requirement for all secondary schools to migrate to online data submission, accompanied by offer of support • Provide support programme as required by schools (to be identified through ICT Integration Plans) to develop skills to use the online EMIS • Generate annual statistical digest for secondary schools for 2014 from the online EMIS	• Contract for EMIS service provider to prepare data import schema • Reliable Internet connections for all participating schools	• EMIS in use in Antigua and Barbuda meets information requirements of MOESYG and management requirements of schools (both primary and secondary) • All secondary schools have reliable Internet connections that will enable use of online system • Private schools can align their systems with data schema of EMIS to export their data
14) *Functional requirements of integrating pre-schools into national EMIS system defined and documented*			
15) *Consultancy to complete design for integration of EMIS and HR Information System completed*			

Rationale/Description	Tasks	Resources Needed	Key Assumptions
These two results both focus on expanding the design of administrative systems to cover new purposes, first by expanding the EMIS to include pre-schools and second by facilitating integration between the EMIS and HR Information System of the Ministry of Finance. Both results are essential to take forward the automation and greater efficiency of school administration through effective use of ICT.	• Identify suitable consultant/s to complete work • Consultant engages key stakeholders and accompanying systems analysis to prepare design documents • Documents circulated for review and comment before finalization • Consultant defines financial requirement to implement design recommendations	• Finances for technical expert	• Pre-schools should be integrated into a single national EMIS
16) 25% of schools using SSTCs as primary maintenance and support system			
Flowing from school ICT Integration Plans, it is expected that maintenance of equipment will be a major component of sustainability plans. Currently, efforts to supply this centrally or through paid service providers are not fully effective. Thus, there is strong justification for integrating students into the maintenance and support systems, using Student Support Technician Clubs (SSTCs). A concept note explaining this idea has already been prepared, and the next step is thus to raise awareness about the approach and encourage schools to adopt it.	• Using mailing list, circulate documentation on SSTCs to school principals • Hold general meeting to introduce the idea to schools and discuss the requirements for take-up • Integrate dedicated planning session on SSTC development into 2014 Summer Institute • Flowing from discussions, identify and implement suitable support strategies from MOESYG to support take-up of SSTCs	• Travel costs to meetings and workshops • Costs of photocopying of resources • Possible sundry budgets to schools to support SSTC setup	• There is sufficient trust in students within school communities and MOESYG to take forward the idea of SSTCs
17) All communication with school principals and teachers circulated electronically			
Given that all principals and teachers will have their own laptops and there will be connectivity at all schools, it is opportune now to ensure that all communication is electronic and that suitable email distribution lists are set up to facilitate regular electronic communication.	• Collect email addresses for all principals, teachers, and school administrators • Set up a range of suitable distribution lists to facilitate electronic communication	• Distribution list facilities	• All teachers are able to access email accounts • All schools are connected to the Internet

3.4 Human Resources

Rationale/Description	Tasks	Resources Needed	Key Assumptions
18) Baseline audit of competency levels of teachers, teacher educators, and MOESYG officials completed and results analysed/documented			
Effective professional development of personnel needs to begin with a grounded understanding of current competency levels. Such an audit can also be used to assess current levels of ICT use in schools, and is thus a valuable resource for planning for activities in this Master Plan. If an audit is completed annually, it	• Finalize design of instruments • Agree on appropriate methodology for distribution of surveys (electronic or paper?) • Distribute and collect survey data	• Personnel to assist with data collection and capture	• There is political commitment to completing the audit • Schools will be required to submit data, with

Rationale/Description	Tasks	Resources Needed	Key Assumptions
will become an integral part of the M&E framework. Draft instruments for conducting a baseline audit have already been completed, so now the challenge is to gather data from across the system.	• Compile report analysis of data and accompanying recommendations	• Possible travel funds to collect Plans where needed • Research expert to complete analytical report	consequences for non-performance
19) In-service modules on Technology Literacy available for delivery and at least 100 teachers complete this module			
An immediate priority is to begin a rolling series of professional development activities for teachers. This can readily commence with delivery of a course design by COL and UNESCO on Technology Literacy (the first level of the UNESCO ICT CFT), which is available under a Creative Commons licence. Following this, the base line audit can then define further professional development priorities.	• ASC Teacher Development Department identified as delivery agency for Technology Literacy module and negotiations concluded to ensure resources and staff are in place for delivery • Invite interested teachers to enrol in module • Enrol a series of cohorts of teachers to complete the modules as part of in-service professional development	• Finances to cover costs of delivery of modules to teachers (salaries, face-to-face sessions, etc)	• A suitable implementing agency can be found, with capacity to deliver a blended learning module • Teachers will be interested in pursuing further professional development
20) Curriculum for training course for school principals on school ICT integration developed			
Accompanying the previous result is a need to develop the capacity of school principals to manage ICT integration effectively. Given this, there is merit in investing in the development of a suitable course, which can potentially be undertaken as part of a regional collaboration within the OECS to make it more cost-effective.	• Identify suitable expert/s to design course • Commission development of curriculum and accompanying materials, to be shared under a Creative Commons licence • Ensure that design is undertaken in consultation with MOESYG to ensure close connection to realities of schooling in Antigua & Barbuda	• Expert to design course	• Donor resources can be secured to invest in a course for school principals • There are existing OERs that can be harnessed during this design to make the process more cost-effective
21) Summer Institute engages at least 25 principals and 50 teachers in some form of professional development			
Ongoing professional development remains a priority, and the Summer Institute is one such vehicle for conducting this. As Such, it will be important to continue planning meaningful professional development opportunities during this Institute.	• Drawing from baseline survey, assess suitable focus areas for Summer Institute • Develop programme of activities • Market Summer Institute well in advance of its implementation • Run Summer Institute	• Refreshments and learning materials for Summer Institute	• Teachers and principals will be willing to attend activities during summer holiday
22) All teacher educators at ASC complete at least one professional development activity			
Further professional development of teacher educators at the ASC has been identified as a high priority to enable them to support teachers in developing their ICT integration. Identification of suitable courses for them to study should be commenced by completing the baseline audit of competencies, following which	• Complete baseline audit of ICT competencies at ASC. • Undertake online scan to identify suitable courses (including MOOCs and other free resources) for enrolment	• Fees for online course enrolments	• Teacher educators are open to developing their ICT Integration skills

Rationale/Description	Tasks	Resources Needed	Key Assumptions
suitable courses can be identified for different people to take according to need.	• Align available courses with identified needs of teacher educators • Ensure that each teacher educator completes at least one suitable professional development activity during 2014 (preferably to be selected by themselves)		
23) Assessment of ASC Associate Degree and Diploma in Education completed in order to determine requirements to align with UNESCO ICT CFT			
As part of the commitment to aligning professional development to the UNESCO ICT CFT, it is important to conduct an analysis of the extent to which current courses cover the learning outcomes of that competence framework.	• Identify suitable expert to conduct assessment • Supply all necessary materials to expert • Expert conducts assessment and prepares report outlining recommendations for further design of courses as necessary to achieve full alignment to UNESCO ICT CFT	• Expert to complete assessment	• There is political commitment within MOESYG and at ASC to align to UNESCO ICT CT
24) 50 people enrolled in CCTI, completing at least 100 modules			
The CCTI has been a very important professional development programme, and will thus be expanded during 2014. In this way, a cadre of ICT Champions and Master Trainers can be developed for the country.	• Identify suitable candidates for enrolment • Assess possibility of using local master trainers to facilitate programme • Negotiate funds to enrol in programme • Launch programme for 2014 • Track progress of students during 2014 with a view to ensuring successful completion	• Enrolment fees to cover costs of tutoring	• There will be sustained interest in deeper studying by a critical mass of educators, teacher trainers, and MOESYG officials

NOTE: more detail on a proposed professional development strategy for ICT in education is presented below.

3.5 Governance

Rationale/Description	Tasks	Resources Needed	Key Assumptions
25) ICT in Education Steering Committee meets quarterly			
The ICT in Education Steering Committee is the key governance structure in the context of this Master Plan, so it is imperative that it meets regularly	• Set schedule of quarterly meetings for 2014 • Ensure adherence to meeting schedule • Circulate minutes of meetings widely through system to communicate key decisions and ensure transparency	• N/A	• There is political commitment to effective use of ICT in education in Antigua and Barbuda
26) Change management strategy developed			

Rationale/Description	Tasks	Resources Needed	Key Assumptions
As this Master Plan is implemented, there will be growing pressure to manage the change it generates. This needs careful thought to avoid growing resistance from those being confronted with the need to behave in ways that are a significant departure from practices to which they have grown accustomed.	• Glean key change management requirements from ICT Integration Plans and other results generated through the Master Plan • Identify key levers for change and likely barriers • Develop suitable change management strategy for ICT in education through a rolling series of consultative discussions	• Expert in change management to provide advice to plan development	• There is political commitment to effective use of ICT in education in Antigua and Barbuda
27) Draft e-waste policy submitted to OECS Ministers for approval			
As technology is more widely distributed across Antigua and Barbuda, so the imperative grows to manage e-waste effectively. This is likely to expensive for the country to do in isolation, so it makes sense for this to be implemented as part of a wider OECS regional strategy. Fortunately, a draft strategy has already been prepared, so the next step is to circulate this to OECS Ministers and agree on a process to implement the strategy.	• Circulate draft strategy to all OECS Ministers • Use an upcoming Ministers' meeting to agree on a process to refine and implement the draft strategy	• N/A	• There is regional acceptance that e-waste management is an urgent priority in the Caribbean

3.6 Monitoring and Evaluation

Rationale/Description	Tasks	Resources Needed	Key Assumptions
28) Monitoring and Evaluation Strategy finalized and approved *29) First annual baselines of ICT infrastructure and human resource capacity completed* *30) First year of impact evaluation of Tablet Initiative completed*			
Effective monitoring and evaluation is a high priority, in order to ensure that the ICT in Education Policy is achieving identified educational goals. A more detailed monitoring and evaluation strategy is presented below.	• Secure approval for broad M&E Strategy • Finalize detailed design for evaluation of Tablet Initiative • Secure monitoring data from ICT Integration Plans and prepare analysis of this data • Commission evaluation of Tablet Initiative • Circulate ICT Integration template to repeat planning ahead of 2014/2015 school year	• Expert to complete evaluation of Tablet Initiative	• Schools will complete ICT Integration plans • New technology will not be supplied to schools that do not complete plans • Outputs of M&E will inform 2015 ICT Master Plan

NOTE: more detail on a proposed monitoring and evaluation framework for ICT in education is presented below.

4 Budget

Below is a budget to cover direct costs associated with achieving the above results. The following budget notes apply:

1) Budgetary provision has not been made for personnel in the proposed Knowledge Management Unit of the MOESYG. However, it is assumed that these posts will be filled over time to provide the necessary human capacity to implement this plan.
2) An exchange rate of EC $2.70 per US$ has been used.
3) Cost of infrastructure and connectivity are not included in this budget, with the exception of a few dedicated items (web servers and teacher laptops). Additional budgets for procurement will need to be extracted from school ICT Integration plans. While separate provision of Internet for schools will need to be made.

5 Content Development Priorities

Several immediate priorities for content development have been identified by MOESYG officials. These are listed below:

1) Agriculture:
    a) Plant propagation techniques (budding, grafting, and layering)
    b) De-beaking
    c) Slaughtering
    d) Operation of machinery
    e) Crop production – planting and transplanting, plant protection (unique crops to Antigua and Barbuda- Antigua Black Pine apple)
    f) Fertilizing techniques
    g) Processing of eggs, fruits, and vegetables
    h) Irrigation Techniques
    i) Rabbit production
    j) Seedling production
    k) Digestive systems of animals
    l) Marketing of Agricultural products (banking, invoicing etc.)
    m) Poultry production (Sanitation, calculating feed conversion etc.)
    n) Castration of animals
    o) Construction in Agriculture
    p) Using a knapsack sprayer

6 A Professional Development Strategy for ICT in Education

Design of the ICT Professional Development Strategy for Educators in Antigua and Barbuda is based on the following key principles and assumptions:

1) It is expected that in design/selection of professional development courses:
    a) *All courses will be competency-based*, both in design of the curriculum and materials and in terms of how assessment is conducted.
    b) The courses will include *appropriate blends of face-to-face learning, in-school activities, and use of e-learning* (with the latter combining both use of Learning Management Systems – LMSs – and existing social networking platforms, such as Facebook and YouTube). To minimize expenses, the MUESYG will deploy a single VLE to be shared by all participants in the process. This approach will serve to ensure that the professional development activities have a direct

and measurable impact on classroom practices, with support provided to teachers at various levels to enable them to implement the skills they acquire through professional development activities as soon as they have learned them. This will also enable the Antigua State College to pilot a blended learning approach, with a view to possible expansion across the Associate Degree and Diploma in Education programmes in order to increase the capacity of the College to deliver teacher training.

2) This Strategy focuses on *integrating the United Nations Educational Scientific and Cultural Organization (UNESCO) ICT Competency Standards for Teachers (CST)* into the curriculum design of all courses, as this set of Standards effectively identifies the teacher as central in developing student ICT capabilities. The UNESCO ICT Competency Framework for Teachers (CFT) creates a common core syllabus that can be used to develop learning materials sharable at a global level, provides a basic set of qualifications that allows teachers to integrate ICT into their teaching; extends teachers' professional development so as to advance their skills in pedagogy, collaboration, and school innovation using ICT, and harmonizes different views and vocabulary regarding the uses of ICT in teacher education.

3) Courses and modules produced through the ICT Professional Development Strategy for Educators will *build on and adapt existing national and international courses and modules* wherever possible, in order to reduce the costs of development and to improve the quality of the courses offered. Examples of sources of existing content that will be explored for possible use will include:
   a) Resources and courses available through the Commonwealth of Learning, most notably within the Commonwealth Computer Navigator's Certificate (CCNC) and the recently re-designed Commonwealth Certificate for Teacher ICT Integration (CCTI), which is an Advanced Certificate in Education designed in accordance with the UNESCO ICT CFT and aimed at teachers and school leaders wishing to focus on ICT integration into school management, teaching, and learning;
   b) Materials and courses from Microsoft's Partners in Learning Programme and the Intel Teach Programme;
   c) Courseware and materials produced through the professional development activities already implemented in Antigua and Barbuda.

4) Extending the principle of harnessing existing content, the ICT Professional Development Strategy for Educators will also facilitate sharing of all courses/modules and associated educational materials by *releasing them as Open Educational Resources (OER) under an appropriate Creative Commons (CC) licence,* so that they are openly accessible and shareable between the key participating institutions, as well as being accessible to all schools in Antigua and Barbuda and to the broader global education community.

5) Regarding future implementation of ICT in schools, it is assumed that:
   a) School principals and management teams will be expected to develop ICT Integration Plans in order to demonstrate clearly how they expect to harness the extensive investments in ICT. This will provide a primary initial focus for professional development of principals in 2014.
   b) ICT infrastructure and connectivity at the Antigua State College Teacher Development Department will be reviewed and upgraded to enable the College to implement an expanded mandate for professional development of educators in the use of ICT in education.
   c) Curriculum Officers will be provided additional travel budget to enable them to function more effectively as a first line of support for ICT Integration in the country. Ideally, they should also receive laptop computers to enable them to run ad hoc and one-on-one training and support sessions in schools more effectively.

Overview of Professional Development Needs

It is possible to analyse the specific requirements of each of the target groups of this Professional Development Strategy, namely:
1) School administrators (principals, vice-principals, and heads of department);
2) Pre- and in-service teachers;
3) Teacher educators;
4) Students; and
5) Ministry Officials (in particular, Curriculum Officers and Education Officers).

The professional development requirements of each group are outlined below.

School Administrators (Principals, vice-Principals, and Heads of Department)

The growing consensus is that, for instructional technologies to be implemented successfully, leadership and administrative support are critical. This means that it is important that school principals are trained in educational technology and have the resources they require to make informed decisions.

To ensure effective use of ICT at school, it is imperative that leadership in schools is supported in the role of ICT leadership for the school. The principal need not be the ICT champion, but he/she does need to be aware of debates surrounding use of ICT in education and of the important role that leaders play in ensuring successful use. Leaders need to be aware of the consequences of working with and maintaining ICT facilities, as well as the financial implications thereof. It is imperative that, after initial training, leaders become part of a broader community of practice, attending ICT conferences, receiving quarterly circulars, e-mail newsletters, participating in online discussion forums, and sharing expertise and experiences.

In addition, there may also be requirements to include specific focuses on use of specialized platforms, including: human resource management systems; education management information systems; communication platforms; portals to access government and systems information and education content; administration and management systems; financial and accounting systems; security software; timetabling systems; and office productivity tools.

Using modules within the CCTI, the focus in professional development in Antigua and Barbuda will be on supporting school administrators to attain levels of competence as defined in the National Educational Technology Standards (NETS) for Administrators of the International Society for Technology in Education (ISTE)[120], with the next phase of professional development drive being to ensure that all schools develop and implement effective ICT Integration Plans. These plans will include, at least:
- A long-term vision for use of ICT in the school;
- Codes of conduct for ICT usage by learners, teachers, management and administration, and the wider community;
- Curriculum policies outlining how the school intends to use ICT to support teaching across learning levels and learning areas/subjects;
- A detailed assessment of ICT requirements;
- Timetables outlining how ICT will be integrated into the school's operations, and what levels of access will be made available to which learners;
- Professional development strategies on use and integration of ICT in educational, management, and administrative tasks;
- School strategies to cover operating costs of ICT; and

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[120] See http://www.iste.org/standards/nets-for-administrators.aspx.

- Strategies for ICT support and maintenance.

Through this process, it is expected that:

1) Schools will be requested, by the end of 2013, to have prepared detailed ICT Integration Plans (based on a template to be supplied by the MOESYG.
2) School administrators will receive ongoing support through online communities of practices, in-school visits from Ministry officials, and access to relevant professional development activities available from 2014 onwards to develop their capacity to manage implementation of their ICT Integration Plans.

Teachers

Teachers are at the heart of delivery of the curriculum. Teacher professional development in use of ICT is best introduced in a context of broader educational reform, which embraces a shift away from teacher-centred, lecture-based instruction toward student-centred, interactive, constructivist learning. Teacher professional development is essential if ICT in schools is to be used effectively. Thus, ongoing teacher training and professional development offerings are vital for successful use of ICT in education. Teachers play a pivotal role in the adaptation and integration of ICT in education as they are a key element in curriculum implementation and innovation. Studies show that insufficient understanding of the scope of an ICT resource leads to inappropriate or superficial uses in the curriculum.

To harness ICT effectively in support of curriculum delivery, teachers require substantial support and stimulation to change entrenched practices. This support includes general approaches to integration of ICT within teaching and learning, support within specific areas of a subject specialization, and training and support on effective use of specific ICT applications and digital education content offerings. To support this, UNESCO's ICT Competency Standards for Teachers[121] are located within a broader policy context of educational reform and sustainable development which views education as a cultural relay that inculcates societal values including the role of the citizen in economic development.

For UNESCO, educational change through ICT encompasses three approaches: technology literacy, knowledge deepening, and knowledge creation, and these approaches have different implications for pedagogy, teacher practice and professional development, curriculum and assessment, and school organization and administration. In relation to pedagogy, the use of ICT requires teachers to develop skills to develop innovative ways of using technology to enhance the learning environment, and to encourage technology literacy, knowledge deepening and knowledge creation. As such, teacher professional development has to focus on developing teachers' knowledge and skills to develop technology literacy, knowledge deepening, and knowledge creation in relation to components of the educational system, that is, policy, curriculum and assessment, pedagogy, the use of technology, school organization and administration, and teacher professional development.

According to UNESCO, the three approaches to educational reform have different demands for teacher education, with the technology literacy approach being the most basic and requiring the most basic policy changes as the aim of this approach is to encourage and facilitate student uptake of new technologies to support social and economic development. Professional development aimed at supporting the technology literacy approach focuses on developing teachers' technological literacy to integrate basic ICT tools into the curriculum. This technology literacy approach requires a focus on equitable distribution of technological resources to enable access by as wide a population as possible

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[121] See http://cst.unesco-ci.org/sites/projects/cst/default.aspx

to lessen the digital divide. The outlay of technological tools at this stage is a precursor for possible success of all three approaches to educational development.

Knowledge deepening educational changes are deeper and they are likely to have greater impact on learning. Knowledge deepening requires students as citizens to apply school knowledge for complex problem solving in the workplace to add value to national development, for example through innovation that provides solutions to national challenges. To achieve this approach to educational reform, teacher professional development should focus on providing teachers with the knowledge and skills to use more complex methodologies and technologies. Change in the curriculum should include establishing a complex relationship between school knowledge and real world problems and can involve collaboration between students at local and global levels with the teacher managing the learning environment.

The knowledge creation approach to educational improvement is the most complex as it aims to create a citizenry that engages in and benefits from knowledge creation, innovation, and participation in lifelong learning. Curriculum changes to achieve the aims of this approach are inculcating skills in collaboration, communication, creative thinking and innovation and critical thinking. Teachers can model these skills to their students through their own professional development where they develop more sophisticated skills on using technology and collaborate with peers to design projects that challenge students to exercise the aforementioned skills.

Given the nature of these above components, the focus in Antigua and Barbuda will be on:
1) Ensuring that all new teachers entering the system, as well as in-service teachers receiving their first qualification, have attained the 'Knowledge Deepening' level of competence through their pre-service training;
2) All teachers in Antigua and Barbuda have attained the 'Technology Literacy' level of competence by the end of 2016;
3) At least 25% of all teachers in Antigua and Barbuda have attained the 'Knowledge Deepening' level of competence by the end of 2016.

Teacher Educators

Given the above, there is an equivalent requirement to ensure that teacher educators attain equivalent levels of competence in ICT Integration. Again, here, the UNESCO ICT CFT provides a sensible framework for curriculum development, while the CCTI provides a helpful mechanism for providing professional development to this target audience, as it is an online programme that allows teacher educators to gain access to mentoring expertise that may not be readily available within Antigua and Barbuda. From this perspective, it will be ideal to have all 11 teacher educators at the Antigua State College, or at least a critical mass of these lecturers, enrolled on CCTI modules during 2014.

Students

The extent of ICT deployment in Antigua and Barbuda and current availability of central technical support suggests that formal technical support will be insufficient to ensure ongoing maintenance of ICT equipment. In addition, there are several emerging examples internationally (for example, in the United States of America, Macedonia, and Indonesia) that students can play an important role in supporting ICT maintenance and repair within schools. Such strategies have also been demonstrated to have significant positive educational and social outcomes for participating students. Consequently, there is merit in exploring development of Student Support Technician Clubs (SSTCs) at schools to provide technical support. This process can usefully be guided by a Computer Lab Sustainability Took Kit developed by AED, Cisco, and Qualcomm.[122] The process will aim to develop technical and

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[122] See http://aed.org/Publications/computer-system-sustainability-toolkit.cfm.

leadership skills in selected students to support technology teachers to maintain computers, troubleshoot problems, and support classroom teachers to integrate ICT for teaching and learning.

MOESYG Officials (particularly Curriculum Officers and Education Officers)

The leadership role of Ministry of Education personnel in changing their own practice and supporting and monitoring schools in their uptake of ICT is pivotal to the success of the country's plans to roll out ICT in education. The areas in which MOESYG personnel require support include: leadership and vision; learning and teaching; productivity and professional practice; support, management, and operations; assessment and evaluation; and social, legal and ethical issues. As they constitute the first line of support to schools, it is essential to ensure that the capacity of new KMU personnel in ICT Integration is systematically developed, while their job descriptions are simultaneously streamlined to provide them the necessary time to implement this support function effectively. Likewise, a focus on professional development of Education Officers and Curriculum Officers will be essential to ensure that key education managers are knowledgeable in the area of ICT Integration.
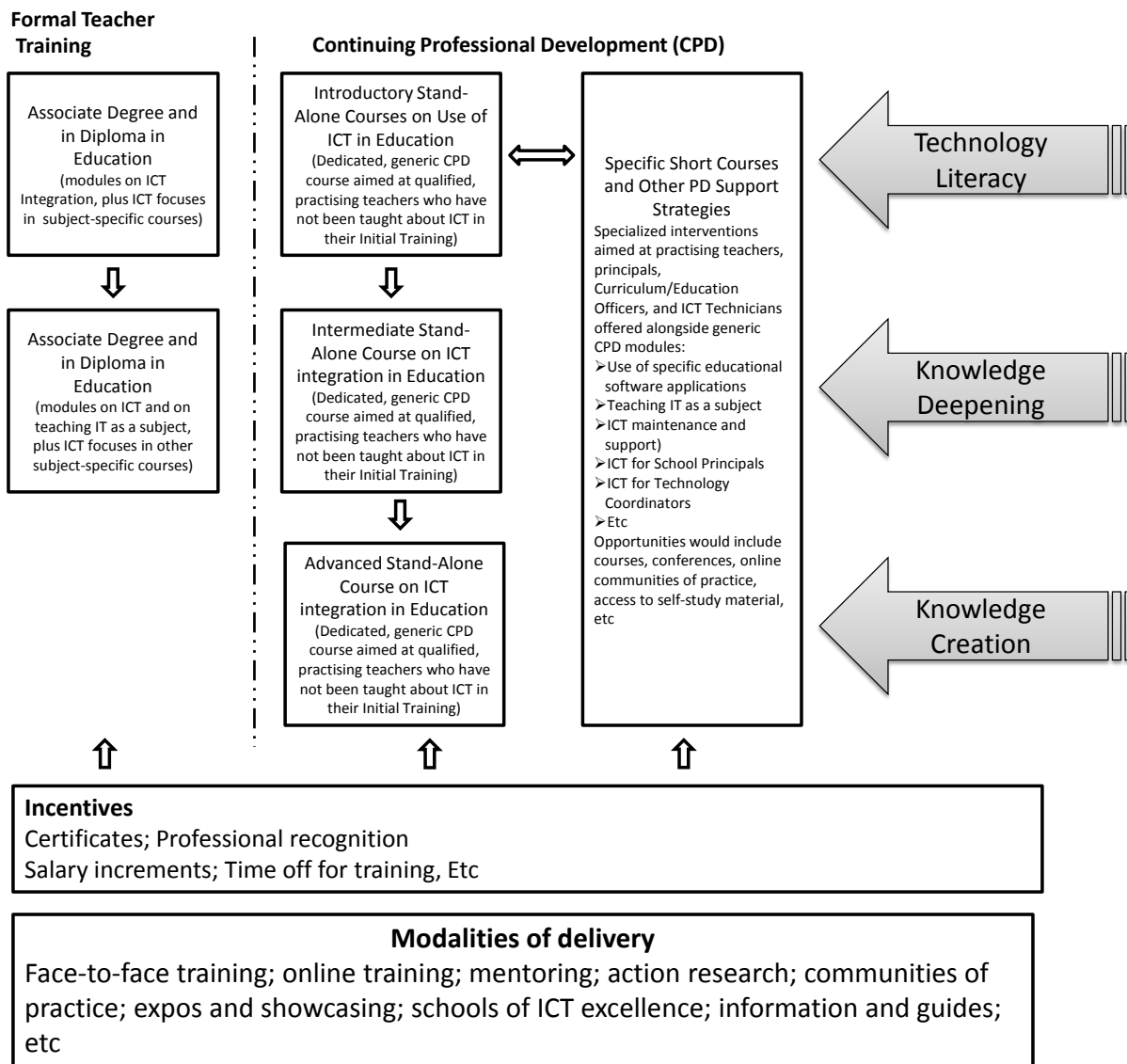
Summary

In summary, therefore, the immediate focus for professional development will be to develop a multi-tiered support structure for teachers, which provides the necessary support and monitoring to ensure effective use of the ICT infrastructure that has been deployed in Antigua and Barbuda. This support structure will comprise:
1) A supportive school environment, with a comprehensive ICT Integration Plan being developed by the ICT Integration Support Team in consultation with all key players, which serves to ensure that school administrators (and especially principals) are supportive of teachers' efforts to use ICT effectively in their classrooms and that school targets in this regard are formally monitored.
2) A first line of support for teachers being provided within the school through Ministry officials and SSTCs.
3) Access to three levels of professional development support for teachers, which seek to move them systematically from Basic ICT Readiness to Technology Literacy to Knowledge Deepening levels of competence (and, for some, beyond to Knowledge Creation). This professional development will be made accessible on an ongoing basis from the beginning of 2014, using the Antigua State College as the key provider.
4) A teacher supply system (through the relevant Associate Degree and Diploma in Education programmes) which ensures that all new teachers entering the system have already attained the Knowledge Deepening level of competence, so that the requirement for ongoing professional development declines systematically over four years.
5) Access to online communities of practice, through which educators in Antigua and Barbuda can share knowledge, resources, and experiences, as well as seeking support from their peers.

6.1 Antigua and Barbuda ICT Professional Development Framework for Educators

The ICT Professional Development Framework for Educators can be presented diagrammatically as follows:

Figure 6   ICT Professional Development Framework for Teachers

Formal Teacher Training

Continuing Professional Development (CPD)

| Associate Degree and in Diploma in Education (modules on ICT Integration, plus ICT focuses in subject-specific courses) |

⇩

| Associate Degree and in Diploma in Education (modules on ICT and on teaching IT as a subject, plus ICT focuses in other subject-specific courses) |

| Introductory Stand-Alone Courses on Use of ICT in Education (Dedicated, generic CPD course aimed at qualified, practising teachers who have not been taught about ICT in their Initial Training) | ⟷ | Specific Short Courses and Other PD Support Strategies |

⇩

| Intermediate Stand-Alone Course on ICT integration in Education (Dedicated, generic CPD course aimed at qualified, practising teachers who have not been taught about ICT in their Initial Training) |

⇩

| Advanced Stand-Alone Course on ICT integration in Education (Dedicated, generic CPD course aimed at qualified, practising teachers who have not been taught about ICT in their Initial Training) |

Specific Short Courses and Other PD Support Strategies
Specialized interventions aimed at practising teachers, principals, Curriculum/Education Officers, and ICT Technicians offered alongside generic CPD modules:
➢Use of specific educational software applications
➢Teaching IT as a subject
➢ICT maintenance and support)
➢ICT for School Principals
➢ICT for Technology Coordinators
➢Etc
Opportunities would include courses, conferences, online communities of practice, access to self-study material, etc

Technology Literacy

Knowledge Deepening

Knowledge Creation

⇧   ⇧   ⇧

Incentives
Certificates; Professional recognition
Salary increments; Time off for training, Etc

Modalities of delivery
Face-to-face training; online training; mentoring; action research; communities of practice; expos and showcasing; schools of ICT excellence; information and guides; etc

The ICT Professional Development Framework for Educators will incorporate various professional development courses as outlined below.

Table 6   Professional Development Courses

Course and Launch Date	Target Audience	Provider	Methodology, Duration, Frequency	Outcomes
Commonwealth Certificate for Teacher ICT Integration	Curriculum Officers Education Officers ASC teacher educators Selected Teachers who are ICT Champions (if feasible)	COL	320 Notional Learning hours over 18 months Predominantly online, with very limited face-to-face interaction New enrolments annually	Successful attainment of competences at Knowledge Deepening Level of UNESCO ICT CFT See curriculum of CCTI for detailed learning outcomes
Associate Degree Programme and Diploma in Education Modules (Primary, Secondary, and ECD teachers) Already operational	Enrolled pre-service and in-service teachers	Antigua State College	180 notional learning hours over 2 years Blended learning – limited face-to-face workshops, combined with online learning, and follow-up in-class assessment activities	Successful attainment of competences at Knowledge Deepening Level of UNESCO ICT CFT
Technology Literacy for Teachers January, 2014	In-service teachers at Basic ICT Readiness level	Antigua State College	90 notional learning hours over 6 weeks Blended learning – limited face-to-face workshops, combined with online learning, and follow-up in-class assessment activities	Successful attainment of competences at Technology Literacy Level of UNESCO ICT CFT Ideally, successful teachers will move onto to complete 'Knowledge Deepening for Teachers' the year after they complete this course
Knowledge Deepening for Teachers January, 2015	In-service teachers at Technology Literacy level	Antigua State College	120 notional learning hours over 6 months Blended learning – limited face-to-face workshops, combined with online	Successful attainment of competences at Knowledge Deepening Level of UNESCO ICT CFT

Course and Launch Date	Target Audience	Provider	Methodology, Duration, Frequency	Outcomes
			learning, in-class assessment activities, and school support visits Twice annually	
ICT Integration for Administrators January, 2015	School Administrators	MOESYG KMU	60 notional learning hours over 6 months Blended learning – limited face-to-face workshops, combined with online learning, in-class assessment activities, and school support visits Once-off implementation, with multiple cohorts, to ensure that all schools develop ICT Integration Plans	Competences defined for principals in ISTE[123] All participating schools will be expected to produce a functional ICT Integration Plan as part of their overall School Plan as a core outcome of this course
SSTC course January, 2015	Students	MOESYG KMU	24 notional hours of learning over three days, with follow-up online support and support from ICT Technicians On demand at schools	See SSTC Toolkit

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[123] See http://www.iste.org/standards/nets-for-administrators.aspx.

Targets for the Professional Development Implementation Plan

Notional targets for each in-service professional development course are presented below. It is important to note that a key constraint in enrolments is the number of mentors available to facilitate courses (numbers below are based on an assumption that each group of 20 students will require one mentor/facilitator).

Table 7   Notional In-Service Course Enrolments

In-Service Course	2014	2015	2016	Total
CCTI	50	50	50	150
Associate Degree Programme Modules	0	???	???	???
Technology Literacy for Teachers	100	150	200	450
Knowledge Deepening for Teachers	N/A	100	150	250
ICT Integration for Administrators	N/A	40	45	85
SSTC course	N/A	80	160	240

6.2   Roles and Responsibilities

As can be seen, the above strategy requires input from various players, whose roles are summarized in the table below:

Table 8   Roles of Key Agencies

Agency	Roles
Antigua State College	• Coordinate development and refinement of PD Strategy/plan, as directed by ICT in Education Steering Committee • Facilitate professional development courses as identified in Framework • Manage enrolments onto courses • Design, establish, maintain monitoring system to ensure progress towards targets • Lead course design process • Ensure that Associate Degree programmes incorporate courses to enable trainee teachers to attain at least a 'Knowledge Deepening' level by graduation • Ensure that Certificate Programme in ICT in Education enables graduates to attain at least a 'Knowledge Deepening' level by graduation • Possible development and provision of a menu of in-service courses (aligned with requirements of PD strategy) as agreed with Professional Development Committee
Planning Unit	• Provide first-level pedagogical support to teachers and principals in schools • Provide overall guidance on infusion of ICT into subject teaching in Antigua and Barbuda • Provide inputs into course design activities • Play key role in monitoring impact of Professional Development Strategy
Antigua and Barbuda Union of Teachers	• Mobilize membership to participate in relevant professional development activities • Provide inputs into course design activities

Agency	Roles
COL	• Key inter-governmental organizations, with strong interest in, and history of, supporting education in Antigua and Barbuda • Able to offer technical assistance and support to the Strategy • Have an interest in replicating similar approaches in other countries if they are successful • Able to offer access to educational resources and materials that may be useful in the Plan, particularly – but not only – through the CCTI and CCNC, as well as other similar work in the Caribbean

7 A Monitoring and Evaluation Framework for ICT in Education

7.1 Monitoring and Evaluation Defined

The concepts of monitoring and evaluation are distinct, but closely related and the line between each is blurred. It is thus important to define carefully how each concept has been used in the context of this plan.

- **Monitoring** is regarded as a type of formative evaluation and continuous observation of implementation progress. Typically, monitoring makes use of routine management information to establish the extent to which targets, outcomes and/or goals are being achieved, and to identify changes occurring. Monitoring usually focuses on the ongoing tracking of inputs, processes and outputs of a strategy or intervention over time.
- **Evaluation** involves the interpretation of monitoring data to discern, explain and assess changes, trends, patterns and causalities. Evaluation research seeks to understand the impact that a strategy or intervention is having and is focused on the implications of what monitoring data shows. In sum, evaluation research takes a deeper and more complex look at monitoring data, and often includes the collection of additional research data to inform evaluative conclusions about impact. Often, evaluation research will raise further questions that need to be considered in later evaluation studies.

It is common for the monitoring function to be done internally (i.e. by those involved in the day to day implementation and management of a strategy or interventions) and evaluation to be conducted by a researcher or research team who are not part of the implementation process (i.e. external researcher(s) or organization).

This monitoring and evaluation plan focuses somewhat greater attention on the monitoring aspect based on the assumption that monitoring will begin immediately and will be an integral part of implementation of the ICT Master Plan. With respect to the evaluation component, this document presents a broad overview of the key evaluation focus areas and objectives and suggests an overall research design. However, it is assumed that the final evaluation plan, including sampling strategy, research instruments, activities and timeframes would be prepared by external researchers appointed to do an evaluation. This is important since the evaluation research is an external study.

8 Defining Monitoring and Evaluation Objectives

As noted in the introductory section above, the monitoring and evaluation plan is closely aligned to the ICT Master Plan. From a monitoring and evaluation point of view, it is possible to identify three main areas of research focus:

1) [Changing] patterns of ICT use and integration into learning environments;
2) Training (capacity building) development (i.e. development of new and tailoring of existing courses), roll out, response to training, and effectiveness of training in changing behaviour in a learning environment; and
3) Explanation of impacts achieved and not achieved.

The specific objectives of the monitoring and evaluation framework are thus to:
1) Track changes in ICT use over time;
2) Track participation in ICT courses/training;
3) Assess the effectiveness of the ICT courses/training offered;
4) Assess the extent to which each of the results specified in the Master Plan have been achieved;
5) Understand the conditions in which anticipated results have and/or have not been achieved; and
6) Identify (as early as possible throughout the implementation process) changes and improvements needed to ensure that the strategy achieves its outcomes.

As noted above, although closely related, monitoring and evaluation are different activities with specific purposes. As such, some of these objectives will be achieved via the internal monitoring process, some through external evaluation and some through monitoring and evaluation combined. The Table shows which of the specific monitoring and evaluation objectives will be assessed through monitoring, evaluation, or both functions.

Table 9   Mapping of monitoring and evaluation objectives to research function

Monitoring and Evaluation Objectives	Monitoring function (Internal)	Evaluation function (External)
1. Track changes in ICT use over time	X	
2. Track participation in ICT courses/training	X	
3. Assess the effectiveness of the ICT courses/training offered	X	X
4. Assess the extent to which each of the Master Plan results have been achieved		X
5. Understand the conditions in which anticipated results have been achieved, and have not been achieved		X
6. Identify changes and improvements needed to ensure that the strategy achieves its outcomes.		X

9   Monitoring design

The previous table showed that there are three main areas of focus for ongoing internal monitoring. In this section, the areas of focus are addressed in turn, with the latter two being presented together due to overlaps in the data collection processes. Thus, a comprehensive monitoring database and methodology is envisaged in which the monitoring data across each of these areas can be both separately and jointly analysed.

Tracking changes in ICT use over time (Monitoring focus one)

The use of ICT – and the effective integration of ICT in educational practices – is one of the key outcomes that the ICT in Education Policy seeks to achieve. As such, tracking changing patterns of use is a critical part of the monitoring research. A baseline survey on the use of ICT in education has already

been developed and data collection will take place at the end of 2013, and then again every year. Draft instruments targeting teachers, teacher educators, and staff in the Ministry of Education have been developed, as has an ICT Integration Planning Template to be completed by schools. These instruments provide the basis for tracking ICT use over time. All schools will be targeted to complete the plans and surveys – baseline in 2013 and then annually in September.

While it will be possible and necessary to assess change on an item-by-item basis for depth of understanding, it is proposed that a set of indicators for monitoring ICT use be defined. These indicators will provide a summary of progress. Annual statistics for each of these indicators will be produced and reported on numerically and graphically in an easy-to-understand format. The ICT use indicators over time will be reported on the Ministry of Education website such that all stakeholders can review progress being made and benchmark their own progress against national averages.

9.1 Tracking participation in ICT courses/training and response of participants (Monitoring focus two and three)

A simple training participation monitoring system will be developed. All training and/or teacher education providers will be requested to collect the following information during all relevant ICT-related courses:
• Signed register with the following details:
    – Pre-service or in-service teacher or MoESYG staff member
    – Participant name
    – Current school (for in-service teachers)
    – Gender
    – Age
    – Subject area specialisation (where relevant)
• Course evaluation forms
    – All participants should complete a course evaluation form on the final day of training
    – A standard course evaluation form will be prepared, with the option to add additional course specific questions as needed.

Both the course registers and course evaluation forms will be available in hard copy for completion by the participating teachers, student teachers, or MoESYG staff. An online version of the course evaluation forms will also be available and, depending on the context of the specific training, either the hard copy or online version can be used. The training provider will be required to capture this information into an online training monitoring system (online evaluation forms will automatically be captured). A simple web interface will be developed to facilitate this process. This approach will allow for real time data collection and ongoing analysis and tracking. The course evaluation forms will be used as one component of the assessment of the effectiveness of the training. The information collected in these forms will be complemented with additional data during the external evaluation (see below). Finally, the data on participation in the ICT capacity building courses will also be sent at regular intervals to the Teacher Services Commission for inclusion as part of the human resource (HR) record of teachers.

9.2 Using Monitoring Data to Influence Practice

The purpose of monitoring is to track performance as part of ongoing management and implementation of the strategy. On the basis of this tracking, decisions can be taken regarding what is working well and where improvements are needed. For monitoring data to be useful, a careful strategy for analysis and reporting is needed in order for monitoring data to inform decision-making

and planning processes. In monitoring the ICT Master Plan, the Planning Officer responsible for ICT will prepare short monthly monitoring reports. The reports will present data according to each of the indicators of ICT use and the key results defined for 2014. Monthly reports will be shared with all Ministry of Education staff members who are involved in the implementation of the strategy, as well as with each of the education providers. A composite version of the monthly reports will be prepared every six months for presentation to the ICT in Education Steering Committee.

10 External Evaluation Design

As described above, evaluation is complementary to monitoring, but has a different purpose. Evaluation seeks to interpret the meaning of monitoring data and to add to this additional information needed to make an assessment of the impact (sometimes referred to as the value-added) of an intervention or strategy. The evaluation research will focus on:

- Assessing the extent to which each of the results specified in the ICT Master Plan have been achieved;
- Understanding the conditions in which anticipated results have been achieved, and have not been achieved; and
- Identifying changes and improvements needed to ensure that the strategy achieves its outcomes.

The external evaluator will consider various sources of verification in order to assess achievement of the results. A review of these sources of verification will be complemented by interviews with key stakeholders identified in the ICT in Education Policy. While this is an important aspect of the evaluation and is essential in understanding the effectiveness of the ICT Master Plan, perhaps even more important is assessing the impact the strategy is having at the classroom level, especially given the centrality of the Tablet Initiative.

As such, the central element of the evaluation research design is a series of school visits. It is proposed that each annual evaluation study sample a total of 10 schools at which to conduct this research. Each year, a different sample of schools should be selected. The external evaluator commissioned to conduct the study will formalise a sampling strategy to be used. It is proposed that at least the following research activities be conducted at the school level:

1) Interview with the school principal, focused on the use of ICT in the school and reflections on any changes taking place;
2) Interviews with teachers;
3) Focus group discussions with school learners;
4) Review of a sample of learners' work demonstrating use of relevant ICTs; and
5) Lesson observations in which ICTs are integrated.

A more detailed evaluation strategy will be designed before the end of 2013.

Appendix C: School ICT Integration Planning

This document is designed to support school leaders and managers to play a more proactive role in managing and exploiting school Information and Communication Technologies (ICT) for effective education. Section A provides a tool to help school management to plan the integration of ICT into school processes in such a way that it provides an integrated solution rather than being tacked onto existing structures. The template aims to help you to quantify ICT requirements and record and track ICT assets over time.

In Section B, we introduce the idea of ICT and related tools and services acting as transformational change agents. Here school leaders and managers are introduced to arguments that call for the school education to be reorganized so that it is more effective in achieving its mission.

Section A: Annual School ICT Integration Plan (Template)

Tips on how to proceed and suggestions on what should be recorded under each heading are provided in the coloured paragraphs. Users can delete these paragraphs and insert school-specific information.

Academic Year	
School Name	
Telephone Number	
School Email Address	
Principal	
Principal Email Address	

1. School Mission

Identify the core functions and values the school is pursuing. You might describe a typical student's values and competencies on graduation. What product is the school community committed to creating? As this statement is at a very high level, it does not necessarily have to say anything specifically about ICT.

2. School vision for ICT

What is the school's long-term vision for the use of ICT and how does this relate to the larger school mission?

3. ICT Priorities for this Calendar Year (1st September – 31st August)

Consider the vision above and decide what needs to be done to advance towards the position described. Then prioritize 3-5 activities that need to be implemented *this year* and in what order. In many ways, these 3-5 activities will be a summary of key decisions made by management after completing this template. Thus, you might want to complete this section only once you have worked through the whole of Section A.

4. Curriculum priorities for ICT

In this section, insert statements outlining how the institution intends to use ICT to support teaching across subjects. This can either be written up by focusing on each subject or as a collective whole. An example for Mathematics has been included below as an example. Please delete and insert the position of your academic departments.

3.1. Mathematics curriculum statements related to ICT:

3.1.1. Priority will be given to the use of calculators and computers as natural media for mathematics learning within a technologically-rich learning environment.

3.1.2. All students have ready access to appropriate technology as a means both to support and extend their mathematics learning experiences.

3.1.3. Teachers at all levels should be actively involved in exploring ways to take full advantage of the potential of technology for mathematics learning within the total curriculum.

3.2. Subject 2

3.2.1.   Priority item 1;

3.2.2.   Priority item 2.

3.3. Subject 3

3.3.1.   Priority item 1;

3.3.2.   Priority item 2.

3.4. Subject 4

3.4.1.   Priority item 1;

3.4.2.   Priority item 2.

3.5. Subject 5

3.5.1.   Priority item 1;

3.5.2.   Priority item 2.

5.   Current Status: Technology and Bandwidth

This section maps the school's current status in terms of ICT infrastructure. What equipment, software, connectivity etc. has already been acquired by the school and what condition are these assets and services in? Is any maintenance or upgrades pending? This table will be significant later when planning new procurements to ensure that purchases are compatible with the existing infrastructure and that no duplication occurs.

Internet Access

Internet Connection type/s (ADSL, LTE, 3G, etc)	
Internet Connection speed (in Mbp/s)	
Coverage of connection (all buildings, administration offices, only, etc)?	

Teacher Laptops

	Functioning	Not Functioning
Total Number of Teachers with Laptops (include principal and school administrator)		

Total Number of Teachers without Laptops (include principal and school administrator)

Student Tablets (Secondary Schools Only)

	Functioning	Not Functioning
Total Number of Grade 10 and 11 Students with Tablets		

Total Number of Grade 10 and 11 Students without Tablets

Other ICT Equipment

#	Existing Items	Function	Quantity	Operational	Date Acquired	Expected year of Upgrade or Replacement	Maintenance required in calendar year
1	Trolley mobile device trolley	Receptacle for the storage and movement of a bank of mobile devices.	1	1	20/03/11	2021	No
2	Android 7' tablets	Individual mobile devises for students and staff to access software applications and the internet.	50	48	20/03/11	2014	2 units require repair. Also need to upgrade memory to 32 GB in all 50 units
3	Wi-Fi Network ADSL Routers	Device used as a gateway onto the Internet using our ADSL line. Devices access the gateway using a wireless network	8	7	11/06/11	2014	No
4	School Server	Central computer that regulates uses of the schools network. It is also used as our e-mail and Internet server. It also coordinates printing requests and access to our laser printer.	1	1	21/01/12	Upgraded annually	Requires a new external hard drive to act as a Back-up device. Also require a spare hard drive in case of failure.
5	Printer	Wireless Laser printer	1	1	21/01/12	2014	20 reams of A4 paper and 4 toner cartridges
7							
8							
9							
10							
11							
12							

6.   Proposed timetable

In this section, identify when the school's computer facilities, (be it a computer lab, trolley of mobile devices, or perhaps classroom clusters of laptops etc.), will be accessed and by whom. Some subjects, such as Computer Science, require dedicated timetabled access to computers. However, at those times when computers are not booked, other subject teachers should be encouraged to use the computers. Below is a generic roster with hypothetical subjects inserted. Replace with school specific timetable information and place in the staff room and/or computer center so that the free periods can be booked out. A full timetable will indicate that the computers are being used, while an empty timetable indicates that the computers are idle. Either way this information is important as it can help management plan for expansion or the need for staff development and support in using ICT for teaching and learning. For the purposes of this document, however, record what regular sessions are planned.

The first grid below anticipates a fixed computer facility such as a computer lab or classroom cluster that contains all the equipment, software and tools you would require to teach using ICT. If the school is using an ICT model where students have access to their own individual devices, then a more flexible roster or even a simple list would suffice for teachers to book out other equipment such as projectors, presentation laptops, and so on. Populate the 2nd table below if this model better characterizes your school ICT setup.

NOTE: You are welcome to delete the table below and replace it with timetables you have already developed yourselves.

Period	Monday	Tuesday	Wednesday	Thursday	Friday
1	G8 Computer Studies	G8 Computer Studies		G8 Computer Studies	
2		G8 Computer Studies			
3	G9 Computer Studies	G9 Computer Studies	G9 Computer Studies		G8 Computer Studies
4		G8 Computer Studies			
5			G9 Computer Studies	G9Computer Studies	G9 Computer Studies
6					
7	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies
8	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies	G10 Computer Studies
9					
PM Sessions		14h00-15h30 Student Support Technicians Club (SSTC): Computer Maintenance			

Week __	Period 1	Period 2	Period 3	Period 4	Period 5	Period 6	Period 7	Period 8	Period 9	Period 10

Day										
Monday										
Tuesday	TT, DP1 & MP1 (AJM)	TT, DP1 & MP1 (AJM)								
Wednesday										
Thursday						DP1 (DS)			DP1 (DS)	
Friday										

Equipment Codes: Staff wanting to book equipment should insert the equipment code and their initial in brackets to book equipment and resources.

Data projector 1	DP1	Tablet Trolley (20 Tablets)	TT						
Data projector 2	DP2	Multi-plug 1 (6 outlets)	MP1						
Mobile Screen	MS	Multi-plug 2 (6 outlets)	MP2						

7. Role/s for ICT in school administration

Most of the above items are focused on using ICT for teaching and learning, as well as improving staff productivity, but what role can ICT play in streamlining school administration? Describe here what the school's targets for ICT use in administration and management are for the calendar year. Consider enrolments, student information, staff information, timetabling, mark/test/exam capture, promotion schedules, reporting, library systems, hostel management, ICT help desk services, asset management, fees & finance etc.

8. ICT to support community involvement

Describe how the school could use ICT to strengthen links with the surrounding community. Some ideas might include:
School Website: This is a good way to promote the official face of the school to the wider community highlighting academic results, sports results, student society events as well as procedural issues such as enrolment, school fee payment options etc.
Parent Communications: ICT can support your efforts to inform the parent body of relevant news and events. This can be done via an electronic newsletter, bulk text messaging, individual e-mails etc.
School Extranet: Create a link for parents into the school network so that they can see homework assignments, notices and leave messages.
Community Services: Student societies could offer various ICT services to the community such as printing, scanning, Internet research etc.

9. Extracurricular access to ICT facilities

Insert clear policies on extended afternoon, weekend, and school holiday use of ICT, accompanied by plans to provide incentives to educators to enable this extended use.

10. Procurement Priorities

In view of the information collected above, now turn your attention to procurements. What equipment is required over and above the existing ICT described in point 4 above? Use the table below, where example data has been used for demonstration purposes. Besides identifying ICT, also cost and determine from where the funds will come. It is also a good practice to justify the procurement. Why is it necessary and does it move the school closer to actualizing the vision described in point 1?

New Equipment for Calendar Year with Rationale.

#	ICT Items	Function	Quantity	Estimated Cost & Potential Fund	Warrantee?
1	10' Android Tablets	Larger screen tablets for teachers.	8	$200 ea to be drawn from the Staff Development Fund.	6 months
	Rationale: Need to increase the number of teachers who feel comfortable using tablets in class. This is important as we want the student tablets to be better utilized in class. For this calendar year we have				

#	ICT Items	Function	Quantity	Estimated Cost & Potential Fund	Warrantee?
	identified 8 teachers who would embrace this approach. The school will provide them with access to a tablet to enable them to develop appropriate lessons for this platform.				
2	PC Tower Computers (Windows Operating System)	Individual non-mobile desktop computers for administration staff to access software applications and the internet.	2	$300 ea. To be drawn from the administration budget.	6 months
	Rationale: Need to start using ICT to improve our administration processes that are currently paper based. We have decided to start with admissions and library. One PC will be positioned in the admin office and the second in the library. They need a Windows OS in order to run the school administration software.				
3	Pencilbox School Administration software	Windows software to facilitate admissions, student information, marks, reports and library.	1	$400 initial fee and then $50 annually after 1st 12 months for support. To be drawn from the administration budget.	1st 12 months support free.
	Rationale: The two new PCs (see above) will be installed with Pencilbox school administration software and will use the calendar year to get the library and admissions modules up and running. Next year's admissions will be processed using the software and all library assets will be loaded into library module and loans tracked using the software.				
4					
	Rationale:				
5					
	Rationale:				

11.   Maintenance plans and strategies to cover operating costs

Acquiring ICT is one thing, maintaining and upgrading it over time is another. How will the school cover its ICT operating costs? It is important that ICT maintenance costs become a regular line item in the school's annual budget. Regular costs could include:
- Replacement/repair of broken or malfunctioning hardware
- Annual software costs: e.g. Antivirus software & school administration package support subscriptions
- Internet monthly costs: Internet Service Provider, line hire or cellular data package.
- Consumables: Paper, toner, ink cartridges etc.
- Every 2-3 years equipment and software upgrades

How might the school meet these regular costs? Existing fund allocations/income could be reorganized so that ICT is incorporated into budgets. Alternatively a student ICT levy could be implemented on top of the regular school fees. Also investigate partnerships with influential parents

or local businesses. Also consider special fund raisers designed to bring in cash and also spread community awareness of the school's ICT needs.

12.   Roles and responsibilities

In this section, identify the roles of the various staff, parents, students, and student societies, as well as outside contractors who will help to coordinate ICT at the school. Below is a list of tasks. Organize them into defined roles for one or more ICT coordinators:

- Acquisition of equipment.
- Set up and installation.
- Daily maintenance (Virus checker updates, cleaning keyboards & mouses, clearing hard drives when full of discarded files, backups, minor repairs such as paper jams, inserting ink cartridges, rebooting routers etc.).
- Serious repairs to ICT when damaged or broken (especially once out of warranty);
- Upgrading ICT after a number of years when existing equipment is obsolete.
- Purchasing of consumables (paper, toner etc.), monthly payments to Internet Service Providers.
- Professional development and training.
- Daily ICT support to students and staff with specific needs.
- Monitoring use.

In addition, it is worth ensuring that both staff and students understand that using the school's ICT platform comes with responsibilities. Computers and the Internet offer an opening to a world of vast content and numerous tools. It is also an excellent communication channel. However, without setting down expectations, both students and staff can abuse the platform by using school bandwidth for private use often at the expense of those trying to use the platform for educational purposes. In order to make responsibilities clear, all parties should sign an ICT Acceptable Use Agreement. (See Appendix A for an example of such a document.)

13.   Staff professional development

What staff professional development (PD) activities are envisaged for the teachers and other staff members of the school? In this section, describe the types of PD initiatives that will use the ICT facilities. Some ideas might include:

Courses: Many staff may be happy to start off with a simple Basic ICT Skills course run by a more knowledgeable and skilled staff member. Later, once they have more skill, online courses focusing on Teaching with ICT might be an option.

Resources: There are also many resources available online that teachers can access to help them with lesson planning as well as materials for their lessons. Vetted lists of subject repositories developed by existing department staff could be compiled to help teachers new to ICT investigate this wealth.

Conferences: There are also numerous ICT in Education conferences that are held around the world, region and often in each country. A delegation from the school would be a good way to build a group of dedicated ICT in Education practitioners at the school who could lead by example and would benefit by hearing about the latest trends, tools and services.

Section B: ICT as an Education Transformation Agent

Section B of this document looks at how ICT can be used by the school community to transform education. Section A introduced ICT as a set of tools and services that could enhance all aspects of a school's operations: teaching and learning, communication, management, and administration. The idea now is can we use ICT and related tools and services to change for the better teaching and learning, communication, management, and administration?

If we are to use ICT as a transformative agent, then this can only really be achieved if ICT has been fully embraced by the school community, the majority of users feel comfortable using technology, and the ICT processes have been incorporated into many of the school operations. For example the Department of Education and Early Childhood Development, State of Victoria (2009) believes that schools go through phases of ICT progression[124].

- Foundation – Beginning the eLearning Journey
- Emergent – Established practices and resources support eLearning implementation
- Innovative – eLearning innovation is embedded in the school culture
- Transformative – eLearning transforms learning and teaching and is evident through wider school change.

While it is not necessary that elements of institutional leadership, curriculum, teaching and learning, access etc. all fall into the final transformative phase before attempting to use ICT as a change agent levels of success are more likely as a school approaches this final phase of progression.

Let's look at some strategies for using ICT to change the way we work. We will do this as a template so that we can focus on how ICT, might in time, be used to improve education at your school.

1.   Restate the school mission

This was mentioned in Section 'A' but again identify the core functions and values the school is pursuing. If necessary, revise it so that it is more challenging. For example you might include additional skills and values that you feel are a prerequisite for success in the digital information age or you might want to increase the percentage of students who qualify for entrance into tertiary education or against another indicator such as an international qualification.

14.   What could be done better?

Keeping in mind the above mission statement, where do you think improvements could be made in school processes so that the mission could be better accomplished. (We are most likely talking about the characteristics of a quality school graduate, so for example how might you create a greater number of graduates that fit this profile, in a shorter time and at a fraction of the cost? What would need to be changed?)

Kaplan & Chan (2011) believe that, if we can free up time in the class, there are eight practices that effective teachers should pursue to improve teaching and learning. These include[125]:

14.1.   Lesson development with emphasis on time on task and student engagement.

14.2.   Prioritize time according to focused learning goals

14.3.   Individualize learning time and instruction based on student needs

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[124] State of Victoria, Dept. Education and Early Childhood Development. (2009). *eLearning Planning Guide*. P 11. Available online at http://epotential.education.vic.gov.au/showcase/elearning_planning/planning_docs

[125] Kaplan, C & Chan, R. (2011). Time Well Spent: Eight Powerful Practices of Successful, Expanded-Time Schools. National Centre on Time & Learning. P14. Available online at http://www.timeandlearning.org/?q=time-well-spent-eight-powerful-practices-successful-expanded-time-schools

14.4.   Use time to build a school culture of high expectations and mutual accountability

14.5.   Use time to provide a well-rounded education

14.6.   Use time to prepare students for college and career

14.7.   Use time to continuously strengthen instruction

14.8.   Use time to relentlessly assess, analyse, and respond to student data.

These goals are all admirable but how might time be found to introduce these practices as priorities for your staff?

Identify and rank 3-4 educator priorities you would like your staff to adopt and then consider how much additional time they would need over and above what they currently need to teach the curriculum.

#	New Educator Priorities
1	
2	
3	
4	

15.   Change predominant pedagogy

A methodology that is gaining popularity with schools that have good access to ICT is flip teaching, sometimes referred to as the flipped classroom[126], where much of the learning done by transmission or simple interactions with peers is done online outside of class time. This means that learning continues outside of the classroom at home, in the bus, or in the school's computer facility after school.

Flip teaching (or flipped classroom) is a form of blended learning in which students watch lectures online and work on problem sets with other students in class. This approach allows teachers to spend more time interacting with students instead of lecturing. This is also known as backwards classroom, reverse instruction, flipping the classroom and reverse teaching[127].

The flipped classroom means that teachers can spend contact time pursuing more meaningful student engagements as suggested by Kaplan and Chan above. Contact time could include identifying student needs and providing individualized learning pathways. Perhaps this might involve enrichment for strong students and remedial work for those requiring additional practice. Practical sessions can be maximized and in-depth discussions are possible when the students have already worked through the theory. These activities help the students assimilate skills, knowledge and values by engaging with the materials using higher order thinking skills over and above mere comprehension.

With more room for student-based activities rather than traditional transmission, the predominant pedagogy begins to move away from teacher-centered, didactic approaches, traditional in many of our classrooms, and begins to align better with student-centered, constructivist learning.

Consider the Knewton graphic here and then do an analysis on your schools readiness to adopt this methodology. Consider required changes to the curriculum and teaching and learning resources, staff competencies, and ICT Infrastructure. What leadership strategies would be required to bring about changes in the status quo in these areas to better support student centered learning? Record your observations in the table below.

1	Changes to curriculum and teaching/learning resources

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126 Knewton Inc. (2013). Flipped Classroom. Available online at http://www.knewton.com/flipped-classroom/

127 Wikipedia. (2013). Flip Teaching. Available online at http://en.wikipedia.org/wiki/Flip_teaching

	Implications:
2	Changes to staff competencies
	Implications:
3	Changes to student access to ICT
	Implications:
4	Changes to Leadership
	Implications:
5	What else needs to be changed?

16. Change access to curriculum resources

A traditional textbook could still provide the content around which learning is centred, but, if a student is to engage with materials outside of contact time, then the resources should be varied and engaging. Video, audio, and animations/simulations can supplement print to maintain interest and provide additional stimulus. Traditionally multimedia has been expensive to acquire but recently quality materials have been released on the Internet with an open licence. A well-known source of free mathematics and science teaching videos is the Khan Academy[128]. There are numerous free science animation sites[129] and a number of free digital textbooks too have been released with an open licence[130].

Open licences allow for the free distribution of the educational resource to colleagues and students. In many instances an open licence also allows an educator to change the resource to better suite his/her students' needs without having to ask for permission. An open licence does require the original author or creator to be acknowledged and it is possible that there are some additional stipulations for their use[131].

Education materials with an open licence are called Open Education Resources (OER) and can include multimedia, textbooks, lesson plans, worksheets, examination papers and tests etc. They normally always come in a digital format, the implication being that an ICT enabled learning environment is best suited to exploit them.

The consequence of this is that training staff to collect, adapt and distribute open education resources of various types to support flipped teaching is a cost-effective process. With careful planning, it is possible to circumnavigate the hurdle of expensive proprietary resources that has been the bane of much lesson planning in the past. In fact the cost to the student of access to media rich materials could be less than what they are paying now for textbooks.

Review the Creative Commons Education website here that provides a brief overview of OER and provides access to some of the more well-known OER repositories. Then consider how ready your staff are to search, collect, adapt and distribute open education resources in a digital format. What needs to be done to get the staff to embrace the use of OER and other open resources? Record your observations in the table below.

---

[128] See example of Khan Academy open education resources at https://www.khanacademy.org/
[129] See Physclips for an example of open licensed science animations at http://www.animations.physics.unsw.edu.au/
[130] See examples of free South African Mathematics and Science textbooks at http://everythingmaths.co.za/
[131] Visit the Creative Commons website for more information about licences at http://creativecommons.org/licenses/

Describe where your staff (and students) are in terms of their readiness to use OER. What professional development is required to encourage staff to embrace OER?

Select the Professional development	
	Basic ICT training
	Office Suite Training: Word Processor, Spreadsheet, Presentation Package etc.
	Familiarization with Internet
	Awareness of OER, Creative Commons licensing and where to find OER on the Internet
	Adaptation techniques of downloaded materials
	Other: List
	Other: List

17. Change student diagnostic processes

Traditionally, teachers collect data about student progress and proficiencies in a non-systematic way. At secondary level, this is particularly pronounced. Subject teachers have access to their own observations of student behavior in class and a set of test results specific to their own subject. The overall performance of the student across all their subjects and extra curricula activities is only revealed after an examination series when a report is generated, often too late to intervene proactively.

The use of an integrated ICT school administration package used to collect student data on a daily basis across all subjects, attendance, and extra-curricular activities allows for the generation of a rich and current set of diagnostic data that can be used immediately. Kaplan and Chan call for teachers to 'relentlessly assess, analyze and respond to student data' but, unless there is a rich data set, it is often difficult to correctly identify those students who are in need of support.

Some of these systems allow staff to run their courses online, ideal for flipped classrooms, providing them with a space to collect together the resources required for online work, communication tools to keep in contact with students when not in class, assessment tools for online quizzes etc. Additional data, not normally available to traditional learning approaches is collected by the system about the student such as login times, duration online, digital resources accessed, contributions to online communication tools as well as performance in online quizzes etc. All this is useful in identifying which students are engaged, which ones need to be chased up and which ones require additional support.

Besides student tracking, a school administration system usually offers many other school administration productivity gains. Many are designed to support enrolments, time table creation, class lists creation, reporting needs, library processes, personnel information, ICT help desk, and occasionally finance.

There are many products that purport to do this, some proprietary others open source[132] but it is worth investigating if the local education authority has sanctioned a particular product. It is in their interests in time to collect this data on a district, provincial and national level to aid them with their policy and procurement decisions.

How is tracking student progress and mastery of competencies handled currently at your school? Is it effective? Who has access to this data and are they the right people? What would need to change in the school in order to improve tracking and diagnosis of student issues? Record your observations here.

1	Describe current student tracking practice. Is it paper based or do you use an ICT system?

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[132] Two open source school management systems worth investigation are Fedena and SchoolTool.

2	Who has access to student data and are these the correct people?	
3	How might student tracking and the diagnostics process be improved?	
4	What additional administrative functionality would you want on top of a student tracking facility?	

Conclusion

Above is just one of many approaches to using ICT to bring about meaningful change to education processes. It uses ICT simply to provide tools and strategies to impact on pedagogy, access to quality resources and the collection of better student data. It has been used here as an illustrative devise and many charter and private schools could argue that they have already begun this process and that they have more ambitious plans. There is an argument that with more learning happening outside of the classroom we should be moving education out into the real world, the workplace rather than keeping it tied to a traditional school environment. Whether you agree with that or not, the point of this exercise, is to show that with informed leadership, good planning, engaged staff and students transformation is possible. We are not tied to the way we have always done things, but could exploit technology to look at teaching and learning in new ways.

Section C: School ICT Acceptable Use Agreement

Below is a suggested set of items that could appear in the school's ICT Acceptable use Agreement a document aimed at alerting students to what is acceptable behavior when using the school's ICT facilities. Delete items that do not apply, adjust statements as necessary and insert additional items as required.

'School Name here' is now offering access to computers and the Internet for student use. This document forms the Acceptable Use Policy for pupil's use of these facilities.

A. Educational Purpose

The 'School Name Here' computer facilities have been established for educational purposes. The term 'educational purposes' includes class activities, career development, and limited high-quality self-discovery activities.

The 'School Name here' computer facilities have not been established as a public access service or a public forum.

'School Name here' has the right to place reasonable restrictions on the material you access or post through the system. You are also expected to follow the Computer Centre Regulations, the School Rules and the law in your use of The 'School Name here' computer facilities.

You may not use The 'School Name here' computer facilities for commercial purposes. This means you may not offer, provide, or purchase products or services through The 'School Name here' computer facilities.

You may not use The 'School Name here' computer facilities for political lobbying. But you may use the system to communicate with elected representatives and to express your opinion on political issues.

B. Student Internet Access

Access to the 'School Name here' computer facilities and the Internet is a privilege which can be removed at any time should a pupil contravene any clauses of this policy.
All students will have access to Internet World Wide Web information resources and e-mail through the school computer facilities.
All students who access the school's Internet connection using private mobile devices such as phones, tablets, MP3 players, laptops etc. will need to adhere to the acceptable behaviors outlined below.

C. Unacceptable Uses

The following uses of The 'School Name here' computer facilities are considered unacceptable:
Personal Safety
You will not post personal contact information about other people. Personal contact information includes addresses, telephone numbers, e-mail addresses etc.
You will not agree to meet with someone you have met or interacted with online without your parent's approval. Your parent should accompany you to this meeting.
You will promptly disclose to the system administrator or any other member of the academic staff any message you receive that is inappropriate or makes you feel uncomfortable.
Illegal Activities
You will not attempt to gain unauthorized access to The 'School Name here' computer facilities or to any other computer system through schools facilities or go beyond your authorized access. This includes attempting to log in through another person's account or access other person's files. These actions are illegal, even if only for the purposes of 'browsing'.
You will not make deliberate attempts to disrupt the computer system or destroy data by spreading computer viruses or by any other means. These actions are illegal.
You will not use The 'School Name here' computer facilities to engage in any other illegal act, such as arranging for a drug sale or the purchase of alcohol, engaging in criminal gang activity, threatening the safety of any person, etc.
System Security
You are responsible for your individual account and should take all reasonable precautions to prevent others from being able to use your account. Under no conditions should you provide your password to any other person.
You will immediately notify a teacher or the system administrator if you have identified a possible security problem. Do not go looking for security problems, because this may be construed as an illegal attempt to gain access.
You will avoid the inadvertent spread of computer viruses.
Inappropriate Language
Restrictions against Inappropriate Language apply to public messages, private messages, and material posted on Web pages and social networks.
You will not use obscene, profane, lewd, vulgar, rude, inflammatory, threatening, or disrespectful language.
You will not post information that could cause damage or a danger of disruption.
You will not engage in personal attacks, including prejudicial or discriminatory attacks.
You will not harass another person. Harassment is persistently acting in a manner that distresses or annoys another person. If you are told by a person to stop sending them messages, you must stop.
You will not knowingly or recklessly post false or defamatory information about a person or organization.
Respect for Privacy

You will not repost a message that was sent to you privately without permission of the person who sent you the message.

You will not post private information about another person.

Respecting Resource Limits.

You will use the system only for educational and career development activities and limited, high-quality, self-discovery activities. There is no limit on use for education and career development activities. The limit on self-discovery activities is no more than 10 hours per week.

You will not download large files unless absolutely necessary. If necessary, you will download the file at a time when the system is not being heavily used and if the file is not related to educational study, immediately remove the file from the system computer.

You will not post chain letters or engage in 'spamming'. Spamming is sending an annoying or unnecessary message to a large number of people.

Accessing and posting to social networks is only permitted outside of formal lesson times.

You will check your e-mail frequently and delete unwanted messages promptly.

Plagiarism and Copyright Infringement

You will not plagiarize works that you find on the Internet. Plagiarism is taking the ideas or writings of others and presenting them as if they were yours.

You will respect the rights of copyright owners. Copyright infringement occurs when you inappropriately reproduce a work that is protected by a copyright. If a work contains language that specifies appropriate use of that work, you should follow the expressed requirements. If you are unsure whether or not you can use a work, you should request permission from the copyright owner. Copyright law can be very confusing. If you have any questions, ask someone who knows about copyright issues.

Inappropriate Access to Material

You will not use the school computer facilities to access material that is profane or obscene (pornography), that advocates illegal acts, or that advocates violence or discrimination towards other people (hate literature). A special exception may be made if the purpose of your access is to conduct research and both your teacher and parent have approved.

If you mistakenly access inappropriate information, you should immediately disclose this to someone in authority. This will protect you against a claim that you have intentionally violated this Policy.

Your parents should instruct you if there is additional material that they think it would be inappropriate for you to access. The school fully expects that you will follow your parent's instructions in this matter.

D. Your Rights

Free Speech

Your right to free speech applies also to your communication on the Internet. The 'School Name here' computer facilities is considered a limited forum, similar to a school newspaper, and therefore the school may restrict your speech for valid educational reasons. The school will not restrict your speech on the basis of a disagreement with the opinions you are expressing.

Search and Seizure.

You should expect only limited privacy in the contents of your personal files on the school system.

Routine maintenance and monitoring of The 'School Name here' computer facilities may lead to discovery that you have violated this Policy, the school rules, or the law.

An individual search will be conducted if there is reasonable suspicion that you have violated this Policy, the school rules, or the law. The investigation will be reasonable and related to the suspected violation.

Your parents have the right at any time to request to see the contents of your e-mail files and any web pages you may have created or posted using the 'School Name here' computer facilities

Due Process

The school will cooperate fully in any investigation related to any illegal activities conducted through the 'School Name here' computer facilities.

In the event there is a claim that you have violated this Policy or the school rules in your use of the 'School Name here' computer facilities, you will be dealt with in the manner set forth in the school rules.

E. Limitation of Liability

The school makes no guarantee that the functions or the services provided by or through the school system will be error-free or without defect. The school will not be responsible for any damage you may suffer, including but not limited to, loss of data or interruptions of service. The school is not responsible for the accuracy or quality of the information obtained through or stored on the system. The school will not be responsible for financial obligations arising through the unauthorized use of the system.

Appendix D: School ICT Integration Plan Template

This document is designed to support school leaders and managers to play a more proactive role in managing and exploiting school Information and Communication Technologies (ICT) for effective education. It provides a tool to help school management to plan the integration of ICT into school processes in such a way that it provides an integrated solution rather than being tacked onto existing structures. The template aims to help you to quantify ICT requirements and record and track ICT assets over time.

Academic Year	
School Name	
Telephone Number	
School Email Address	
Principal	
Principal Email Address	

18. School Mission

19. School vision for ICT

20. ICT Priorities for this Calendar Year (1st September – 31st August)

1)   2)   3)

21. Curriculum priorities for ICT

6.1. Subject 1

6.1.1. Priority item 1;

6.1.2. Priority item 2.

6.2. Subject 2

6.2.1. Priority item 1;

6.2.2. Priority item 2.

6.3. Subject 3

6.3.1. Priority item 1;

6.3.2. Priority item 2.

6.4. Subject 4

    6.4.1.   Priority item 1;

    6.4.2.   Priority item 2.

6.5. Subject 5

    6.5.1.   Priority item 1;

    6.5.2.   Priority item 2.

6.6. Subject 6

    6.6.1.   Priority item 1;

    6.6.2.   Priority item 2.

22.   Current Status: Technology and Bandwidth

Internet Access

Internet Connection type/s (ADSL, LTE, 3G, etc)	
Internet Connection speed (in Mbp/s)	
Coverage of connection (all buildings, administration offices, only, etc)?	

Teacher Laptops

	Functioning	Not Functioning
Total Number of Teachers with laptops (include principal and school administrator)		

Total Number of Teachers without laptops (include principal and school administrator)	

Describe the main purposes for which teachers use their laptops:

Student Tablets (Secondary Schools Only)

	Functioning	Not Functioning
Total Number of Grade 10 and 11 Students with Tablets		

Total Number of Grade 10 and 11 Students without Tablets	

Main Reasons why students without tablets have not acquired them (please ask all students the reasons why they did not get tablets and then add up the totals in the table below):

	Total Students For Whom This Reason Applies
Lack of awareness of reasons for submission of tablets	
Parents reluctant to cover financial cost of replacement	
Unable to visit distribution point on dates of distribution (due to travel or other logistical constraints)	
Other	

Please summarize any other key reasons specified explaining why students did not acquire tablets:

Other ICT Equipment

#	Existing Items	Function	Quantity	Operational	Date Acquired	Expected year of Upgrade or Replacement	Maintenance required in calendar year
1	Trolley mobile device trolley	Receptacle for the storage and movement of a bank of mobile devices.	1	1	20/03/11	2021	No
2	Wi-Fi Network ADSL Routers	Device used as a gateway onto the Internet using our ADSL line. Devices access the gateway using a wireless network	8	7	11/06/11	2014	No
3	School Server	Central computer that regulates uses of the schools network. It is also used as our e-mail and Internet server. It also coordinates printing requests and access to our laser printer.	1	1	21/01/12	Upgraded annually	Requires a new external hard drive to act as a Back-up device. Also require a spare hard drive in case of failure.
5	Printer	Wireless Laser printer	1	1	21/01/12	2014	20 reams of A4 paper and 4 toner cartridges
6							
7							
8							
9							
10							
11							

23.   Proposed timetable

NOTE: You are welcome to use your own timetables or use the table provided in the guide.

24.   Role/s for ICT in school administration

25.   ICT to support community involvement

26.   Extracurricular access to ICT facilities

27.   Procurement Priorities

New Equipment for Calendar Year with Rationale. Please list items required from highest to lowest order of priority. Add new rows to the table if you have more than five priorities.

#	ICT Items	Function	Quantity	Estimated Cost & Potential Fund	Warrantee?
1					
	Rationale:				
2					
	Rationale:				
3					
	Rationale:				
4					
	Rationale:				
5					
	Rationale:				

28.   Maintenance plans and strategies to cover operating costs

29. Roles and responsibilities

In the table below, indicate who is responsible for the listed functions, and then add any others missing from the table.

Key Role	Person/People Responsible
Acquisition of equipment	
Setup and maintenance of equipment	
Repair of equipment	
Maintenance of Internet Connection	
Anti-virus scheduling and updating	
Data backups	
Coordination of professional development	

30. Staff professional development

NOTE: please provide a general overview of professional development needs at your school below. Separately please ask all teachers to complete the Teacher ICT Competency Survey sent with this planning template.

Appendix E: User Guide for the OER Textbook Prototype

A] Accessing the OER Textbook Prototype

Access

1. Navigate to http://www.caribbeanoer.org
2. The home page should look similar to the image below.

Figure 1
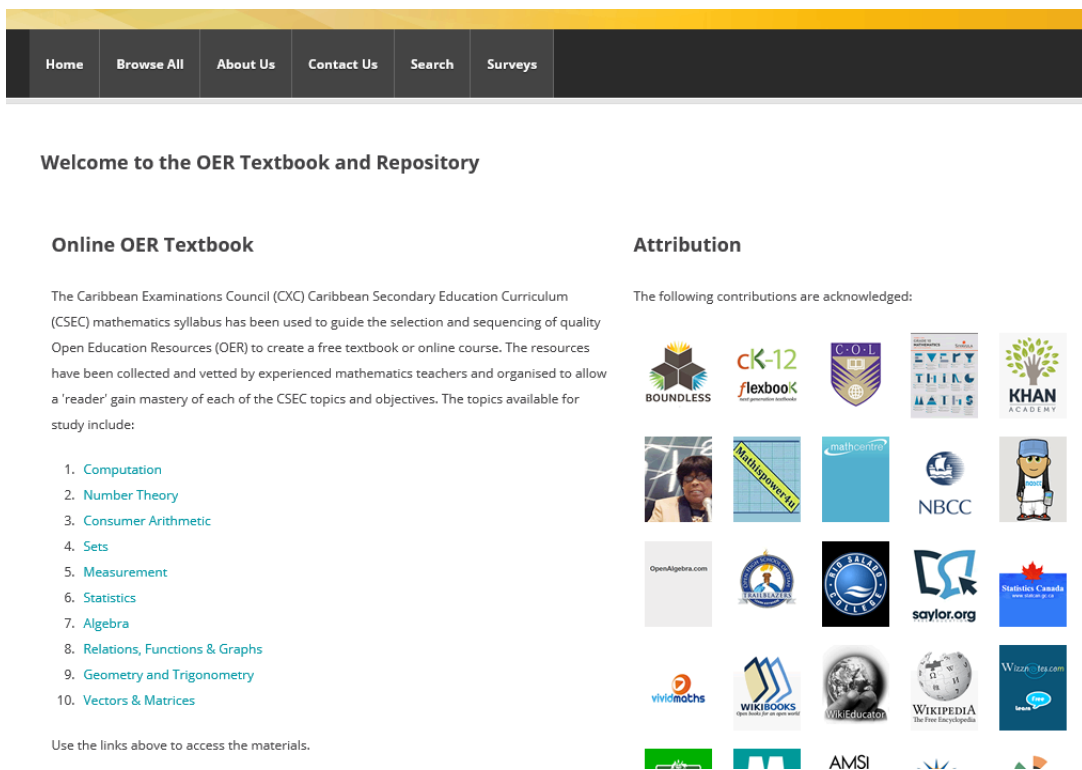
3. Use the search facility to look for Open Education Resources (OER) that contain you key words (Fig 2) or use the topic list at the bottom of the screen to identify resources from a particular grade and topic (Fig 3).

Figure 7
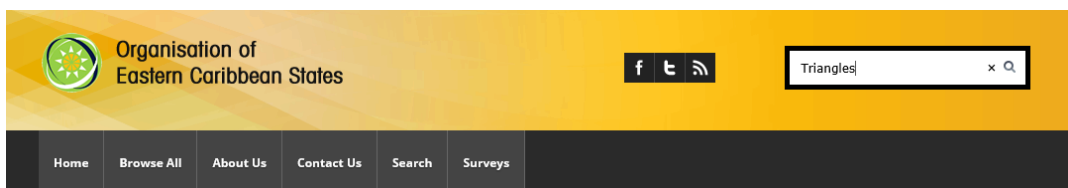
Figure 8
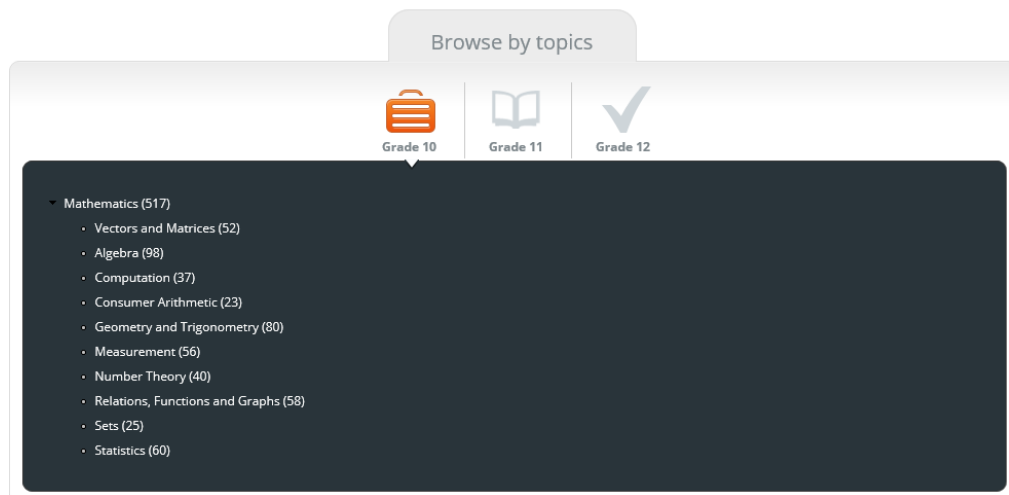
4. To access the lessons use the mathematics topic list on the home page to move from the repository to the learner management system (LMS). These links allow public access to each Mathematics topic so no login is required.

5. If you have correctly selected the public link for 'Number Theory', for example, the screen will look like the image below.

Navigation

6. To work through the OER which have here been organized into a sequence designed to support the acquisition of each curriculum objective click the first page and then use the LMS navigation buttons 'Next' and 'Previous' to move from one OER to the next.
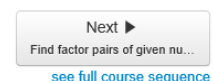
B] Logging into the OER Textbook Prototype Learner Management System

In order to repurpose the OER Textbook prototype to better suite teaching styles and learning preferences you will need to have additional permissions. These permissions have been set up the person allocated as your school administrator. In order for the permissions to work you need to identify yourself to the Learner Management System (LMS). You need to login.

Access

Access is different from how you accessed the LMS before. Previously you used public access to access the OER but in order to see the login screen you need to:

1. Navigate to http://lms.caribbeanoer.org
2. A login screen appears.
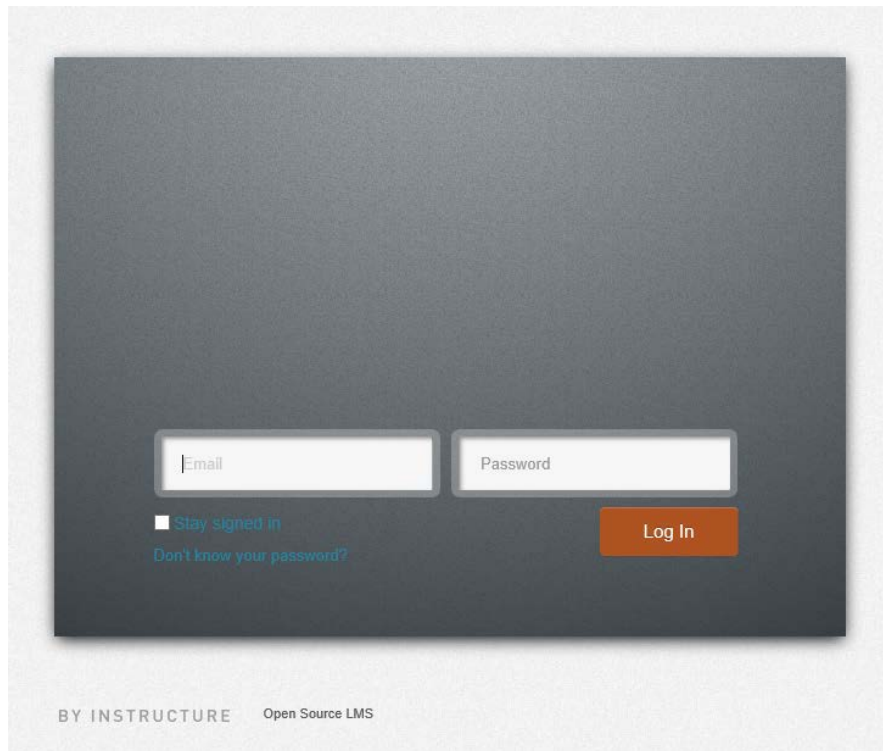
3. Insert the login details provided by your LMS administrator and click the red 'Log In' button.
4. The LMS loads as before but this time you also have your own Menu system that shows you which courses you have been registered for. Mouse over the 'Courses' menu item and a drop down menu appears. It should look similar to the image below.
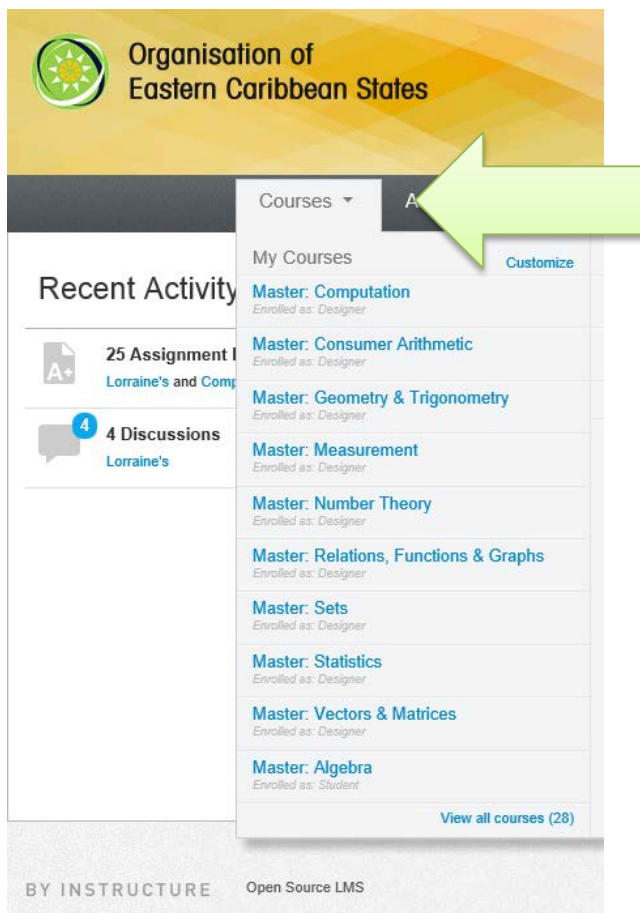
5. In addition you should see your login name in a green panel in the top right hand corner of the screen. This means you have successfully logged in. You can edit your profile and add a photo by clicking on your login name.
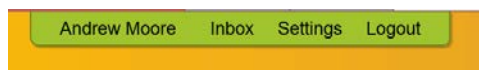
6. Select the topic you have been allocated. When the topic loads look to see if the following tool is visible: an industrial cog. If you can see it then it means you have been assigned the correct permissions to allow repurposing the OER Textbook.
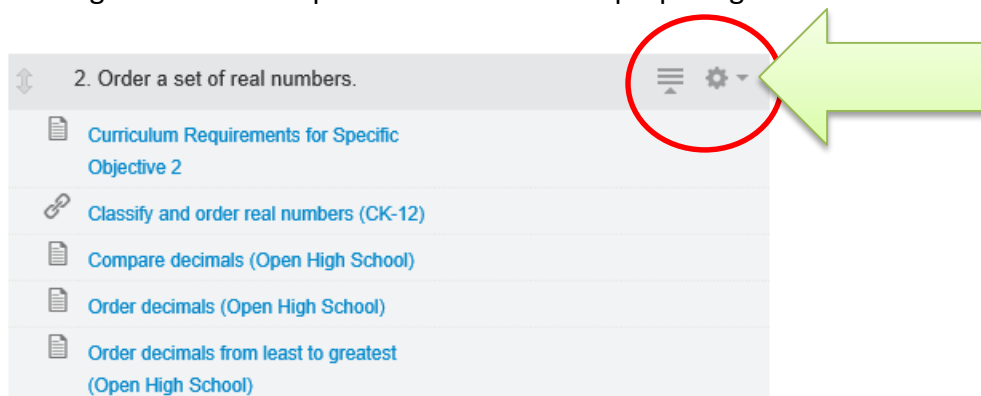
C] Repurposing the OER Textbook Prototype (Add, Delete & Sequence OER)

As a permissioned user you have a number of new abilities: You can add resources, delete resources and change the sequence of the resources. Make sure that you are logged in first then follow the instructions below.

Change the Sequence

Should you decide to change the order, or sequence of the OER:
1. Make sure you are on the module view of the mathematics topic. If not select the 'see full course sequence' hyperlink at the bottom of the page.
2. Place your cursor over the two sided arrow icon that appears on both the module divisions (grey strip) and on each of the resources. The icon appears on the extreme left hand side. When in the correct position your cursor changes to a four sided arrow.
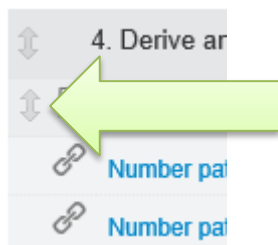
3. Click and drag the resource to its new position and release. The module resources will reshuffle to show the new sequence.

Delete a Resource

Should you decide that a resource is no longer relevant and you want it removed...
4. Ensure that you are in the module view.
5. Place your cursor over the small round circle with a cross inside that appears on the extreme right hand side of the resource.
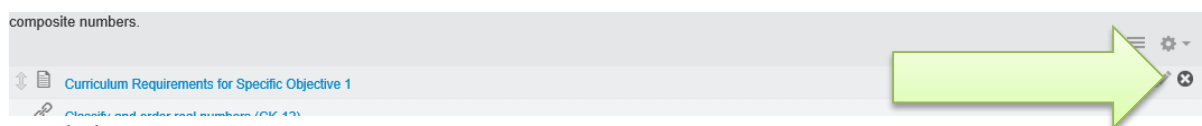
6. Click to remove.

Add a Resource

Should you find another open resource or perhaps want to load your own documents into the module then add a resource.
1. In the module strip (the grey area) select the industrial cog that appears on the extreme right hand side of the strip. A drop down menu provides you with three options.
2. Select '+ Add Content'
3. The following options appear:
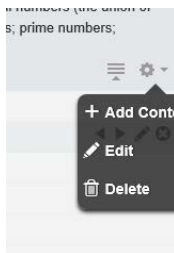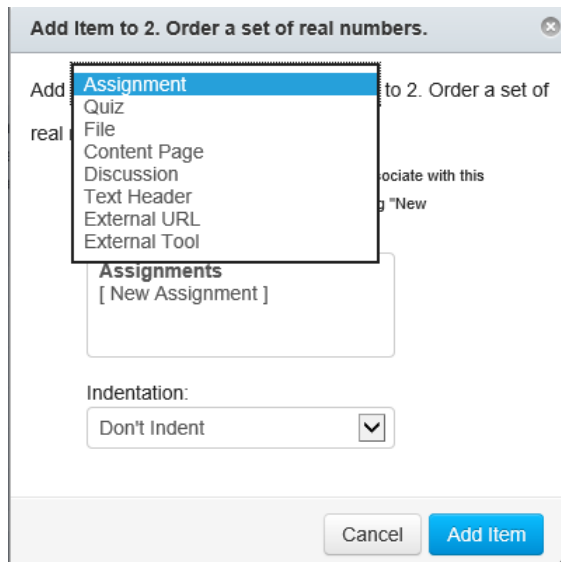
For the pilot experiment with adding: 'File' and 'External URL'. If you feel adventurous try adding a 'Content Page'. This is an internal LMS page which you can customise using a rich text editor.

4. After making a resource selection make sure you select '[New File]' or '[New URL]'.
5. If you chose [New File] then you will be asked to identify the file on your computer.
6. If you chose [New URL] you will be asked to provide a URL and a Page Name for the web resource. The name you choose will appear in the module list so make sure you get the spelling correct.
7. Finally click the 'Add Item' button.
8. The new item appears at the bottom of the module resource list. Drag the resource to its correct place within the module.

D] Creating a Quiz in the LMS

There is one quiz at the end of each topic. Why not add a simple multiple choice quiz at the end of each module?

Create a Quiz

1. In the module strip (the grey area) where you want the quiz to appear select the industrial cog that appears on the extreme right hand side of the strip. A drop down menu provides you with three options. Select '+ Add Content'
2. Select 'Quiz'
3. Select '[New Quiz]'
4. Provide a 'Quiz Name'
5. Click the 'Add Item' button.

6. The quiz appears at the bottom of the module list but currently there is no substance to the quiz. Look for it and then click the hyperlink to open it.
7. On opening notice that the quiz is 'unpublished' meaning that users can't yet access it. Also all the quiz logistics are undefined.

8. Select the 'Edit' button that appears on the right hand side of the window.
9. Insert your quiz instructions inside the rich text editor box.
10. Change the quiz type to 'Ungraded Quiz'. This will allow public users who are not logged in access to your quiz.
11. Change 'Shuffle Answers' to 'Yes'

12. Impose a time limit in minutes
13. Allow 'Multiple Attempts'
14. Make sure 'Show Correct Answers' is set as 'Yes'
15. Leave the 'Due date' and 'From', 'Until' dates blank (unchanged)
16. Click the blue 'Save' button on completion.

Logistics have been sorted out but there are still no questions.

Add Multiple Choice Questions

There are many types of questions (See options, right) you can set but for this activity we will create a set of Multiple Choice questions.

1. Make sure you have selected the 'Questions' tab at the top of the quiz editing page. The default is 'Settings' so it will need to be changed.
2. Provide the question with a name.
3. Select 'Add New Question' button.
4. Then select 'Multiple Choice' from the question type drop down menu.
5. Your screen should look like this:
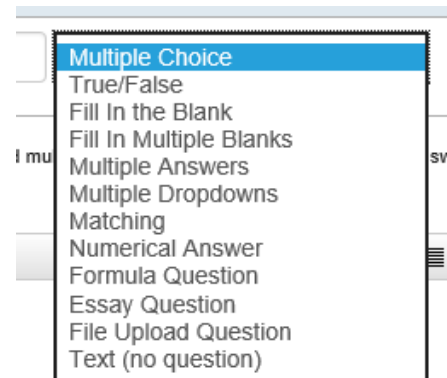
6. Determine how many points this question is for and insert a value in the 'pts' field in the top right hand corner.
7. Insert your question in the top textbox.
8. Then load in four potential answers of which only one is correct.
9. Click next to the correct answer so that the little Green arrow identifies the correct answer.
10. In the green box at the bottom load in a comment that will be delivered to the students who selects the correct answer
11. In the pink box at the bottom load in a comment that will be delivered to the students who selects the wrong answer. Ideally the feedback should help the student do better next time.
12. If you have a general comment that both right and wrong responses should see load this text into the grey box.
13. Make sure you select the blue 'Update Question' button on completion.

Publish the Quiz

1. As designer you can 'preview' the quiz to see how it might look to users. Save all your work and then go back to the quizzes landing page. Look for and select the 'Preview' button in the top right hand corners.
2. Before users can see and access the quiz you need to publish the quiz. Next to the 'Preview' Button there is a blue 'Publish' button inside a yellow alert box at the top of the screen. Select it to allow others access.
3. Return to the module page and reposition the quiz into its correct place amongst the other resources by clicking and dragging the quiz.