Raising Learning Outcomes:
the opportunities and challenges of ICT for learning

unicef
for every child

Appendix 1

Lessons from system stories - Singapore, New Zealand and Brazil

Innovation Unit
New solutions for thriving societies

AGA KHAN FOUNDATION

Aga Khan Education Services

Lessons from system stories - Singapore, New Zealand and Brazil

The systems we have chosen are intentionally diverse in almost every way imaginable: their geographies, economies, cultures and histories are utterly different from one another, aiming to draw lessons from a breadth of different contexts – Singapore, New Zealand and Brazil.

Singapore is small in size with 366 schools. In New Zealand, schools are significantly decentralised and autonomous, organised into networks across a geographically wide area. Interestingly while New Zealand has 60% more students than Singapore it has nearly seven times as many schools, serving suburban and rural communities, contrasting with the City State of Singapore. Brazil has significant geographical, political and cultural diversity. Whereas coherent policy making and administration are possible in New Zealand and Singapore, Brazil presents a more complex challenge to designing and implementing education strategy, comprising as it does multiple and diverse jurisdictions.

What these three countries share with one another is a strong belief in the value of education for the prosperity of their young people and their countries, which translates into both political attention to and financial investment in education in general and, recently, ICT for learning in particular.

Brazil and New Zealand are two of the top three spenders on education in the OECD each investing around 13% of their total public spending budget in education, 60% more than the 8% OECD average. Singapore will, in 2017, spend $12.9 billion on education, the second largest ministry budget, topped only by defence at $14.2 billion.

Singapore, New Zealand and Brazil are also systems which out-perform others like them. Singapore is a very high-performing system that has outpaced all other systems in its improvement. In 2015, Singapore became the top-performing education system in the Program of International Student Assessment (PISA), operated by the OECD. 15 year olds in Singapore score the highest on average in Literacy, Maths and Science, in assessment designed to test application of knowledge and skills. Its 2012-2015 score improvements in Science and Reading were amongst the highest of all above-average countries; in Maths, it was one of few countries that did not have a decline.

In the same year, Singapore's 10 and 14 year olds scored highest in the Trends in International Mathematics and Science Study (TIMSS), which assesses more curriculum-based knowledge and skills. In 2015, scores in Singapore where the highest for over a decade. Despite an already high starting point, the average maths score for 10 and 14 year olds has continuously improved since 2003. As such Singapore kept pace with and then finally exceeded comparable improvements in other East Asian countries.

New Zealand is a system that performs above average in the OECD. While, like most high-income countries, it has seen a small decline in average scores, the decline has not been so substantial, and from 2012 to 2015 New Zealand improved its relative standing. It has also managed to decrease the influence of social background on student performance in PISA. Beyond foundational skills, New Zealand has positioned itself well to prepare its young people for the future. In 2017, the Worldwide Educating for the Future Index, developed by the Economist Intelligence Unit, ranked New Zealand top amongst 35 high-income countries. The index is made up of 16 indicators, which cover a range of aspects of policy and teaching to offer a judgment of how well students are being prepared for the future.

Brazil, meanwhile, has made considerable improvement from a lower starting point. From 2003 to 2012, it has the highest improvement in Mathematics of all countries. During this period, Brazil was also supporting many more young people to stay at school who otherwise would drop out into the unrecorded cohort, making its sustained improvement all the more remarkable.[6] From 2012 to 2015, it continued to make progress and saw improvement in both Maths and Science scores.

Investment in education is, in each of our three focus systems, a direct consequence of political agendas that place education at the heart of a nation-building narrative. From post-independence prosperity in Singapore, to democratic and economic participation in Brazil, and equity and reconciliation with indigenous communities in New Zealand, education has featured in each system as a dynamic force for societal change supported by coherent government policies and consistent investment.

As we have noticed, being clear about the purpose and specific contribution that ICT for learning can make is fundamental to both understanding and realising its potential. These histories and conditions are therefore important to note as a first step to understanding the ICT for learning journeys so far of Singapore, New Zealand and Brazil.

The following takes a closer look at each system and the role that ICT for learning is playing in the latest instalments in these fascinating stories.

(1) OECD (2017), Public spending on education (indicator). doi: 10.1787/f99b45d0-en

(2) http://www.singaporebudget.gov.sg/data/budget_2017/download/05%20Government%20Expenditure%202017.pdf

(3) OECD (2016) PISA: Results in Focus. https://www.oecd.org/pisa/pisa-2015-results-in-focus.pdf

(4) PISA 2015: New Zealand Summary Report. Education Counts. https://www.educationcounts.govt.nz/publications/series/PISA/pisa-2015/pisa-2015-summary-report

(5) The Worldwide Education for the Future Index. Economist Intelligence Unit. http://educatingforthefuture.economist.com/

(6) OECD Country note – Results from PISA 2012: Brazil. https://www.oecd.org/brazil/PISA-2012-results-brazil.pdf See also: "Pisa tests: Turks and Brazilians have shown most progress." Financial Times, December 4 2013. https://www.ft.com/content/61d56292-919d-36c8-8514-6fe1076b2c0f

Singapore

Currently on their fourth Technology Master plan (2015 onwards)[7] the Singapore government has pursued a systematic and systemic approach to the introduction of ICT for learning into schools and continuing support for its effective adoption and deployment for teaching and learning.

Master plans 1-3 focused on:[8]

Master plan 1(1997 – 2002 $2bn) 'Building the foundation for technology' aims were to:

- provide all schools with the basic infrastructure to support technology
- provide training of teachers to use technology (by sending team of trainers to each school)
- target to have ICT-enabled lessons for 30% of curriculum time
- create a change in mindset of teachers to embrace ICT as a tool for teaching and learning
- introduce telecommunications tools to enable students to collaborate with people elsewhere to resolve problems.

Master plan 2(2003 – 2008 $600m) 'Seeding innovation in schools' aims were to:

- introduce baseline ICT Standards for students to achieve at certain milestones
- develop alternative pedagogies (inquiry-based learning and problem-based learning and usage of virtual worlds and blogs, wikis, podcasts, e-portfolios, animations and video production, as well as mobile learning)
- stimulate innovative use of ICT in schools in daily learning (recognition as LEAD ICT@ Schools or FutureSchools@Singapore)
- have schools produce digital content and expand the resource base for others to share (i.e. West Zone Sharing of Resources Project, WeSHARE && Inter-cluster Sharing of Resources project, iSHARE).

Master plan 3(2009 - 2014) 'Strengthening and scaling technology' aims were to:

- strengthen competencies for self-directed learning
- tailor learning experiences according to the way that each student learns best
- encourage students to go deeper and advance their learning
- enable students to learn anywhere.

Master plan 4 offers a vision for future ready and responsible digital learners, where quality learning is in the hands of every learner, empowered with technology. In this vision teachers are designers of learning experiences and environments and school leaders are culture builders.

The aims of master plan 4 are to:

1 bring ICT into the core of the education process (from planning and design of lessons to testing)
2 focus on improving the capabilities and skill sets of teachers (ICT-savvy must also be able to translate into effective teaching)
3 improve the sharing of best practices and successful innovations
4 further build up infrastructure (in phases according to readiness of schools and teachers).

(7) https://ictconnection.moe.edu.sg/masterplan-4/our-ict-journey

(8) https://wiki.nus.edu.sg/display/SPORE/3.+Compare+Three+Masterplans+in+Education

From a teacher and school leader perspective there are currently three opportunities to engage with Master plan 4

- The Future Schools Project - A set of test bed schools, seen as 'trailblazers', selected for their use of ICT for learning as suitable sites for ICT projects which develop ICT for learning innovations that can be adopted by other schools.
- eduLab 2017 - schools who are tasked with developing ICT innovations so that they can be adopted by schools across the system.
- ExCEL Fest - an annual event attracting over 13,000 people each year, which features exciting and innovative practices in schools. It is also where parents and members of the public can find out about the latest education technology developments in school.

Taken together these three represent a coherent strategy for scaling innovation in the use of ICT for learning in Singaporean schools:[9]

- Future schools are the incubators for new tech and new pedagogy
- EduLab schools are the early adopters where new tech and new pedagogy are adapted for widespread use in a variety of contexts
- And ExCel Fest is the big awareness and interest raising event which feeds the pipeline of new ideas on the one hand (supply) and new adopters on the other (demand).

New Zealand

New Zealand has long been a top performer in international league tables in relation to student performance. However, the gap between the highest and lowest performing students in New Zealand is wider than in any of the other high performing countries. Students from Maori and Pasifika communities are at a particular disadvantage.

The New Zealand government sees another gap opening up in employment opportunities in science and technology. Demand for digital skills is on the increase and New Zealand's schools need to be preparing all young people to meet that demand.

The solution to meeting these twin challenges in New Zealand has been a coherent and concerted national focus on STEM subjects (science, technology, engineering and mathematics) in schools, with an emphasis on generating demand through engagement and inspiration as well as ensuring supply and quality. Funding and other incentives have been targeted to schools in disadvantaged areas, termed low decile in the New Zealand system.

Four strategic systemic interventions have been introduced to drive up student engagement and performance in STEM subjects. They are:

1. A public campaign to grow public awareness of and demand for STEM education

A Nation of Curious Minds[10] is a collaboration between the Ministry of Business, Innovation and Enterprise and the Ministry of Education. Curious Minds is a ten-year campaign to support all New Zealanders to engage with science and technology. Targeting young people and, in particular, young people not currently engaging and science and technology, Curious Minds aims to create:

- more science and technology-competent learners, and more choosing science, technology, engineering and mathematics (STEM)-related career pathways;
- a more scientifically and technologically engaged public and a more publicly engaged science sector;
- a more skilled workforce and more responsive science and technology.

Curious Minds reaches out beyond schools and into communities, connecting young people with scientists and technologists to grow demand for engagement with science and technology. Nevertheless many of the 101 projects are led by or include schools.

The campaign also includes a review of the positioning and content of digital technologies within the NZ national curriculum and Te Marautanga o Aotearoa (the national curriculum for Māori-medium).[11]

2. Significant, sustained and systematic investment in infrastructure

Over $700 million (NZD) has so far been spent to provide high speed broadband for New Zealand's schools. N4L (Network for Learning) is a national provider for schools, partnering with government to provide high-speed connectivity to a quality assured network, enhanced by a platform for school-to-school collaboration and access to curriculum resources and administrative support. Training for teachers and co-design of new products are the final parts of this picture. Current policies are now building on this infrastructure. The Ministry of Education has worked with school leaders to develop a Digital Technologies curriculum. This will sit within the national curriculum and include a focus on computational thinking and digital design. A draft has been released and the Ministry of Education has committed NZ$40million to invest in developing teachers' capacity to teach the curriculum.

To ensure that assessment matches curriculum, the New Zealand Qualifications Authority (NZQA) is implementing a digital strategy such that by 2019, external assessments for the National Certificate of Educational Achievement will take place online. This is seen as the first step in transitioning to more adaptive or more complex computer-based assessment.

3. Enhancements to teacher education, initial and continuing, to increase the quality and supply of STEM teaching

(i) Initial Teacher Education

Teach First[12] is a leadership programme designed to attract high achieving graduates into teaching as a first or early career move. In New Zealand, to harmonise with the focus on STEM, candidates are recruited with science and technology degrees and deployed to teaching STEM subjects in schools in the most disadvantaged communities across New Zealand. Of the 5000 students taught by Teach First teachers, 4200 are Maori or Pasifika. The evaluation of the programme's pilot phase (2013-16) concluded that the programme was successfully implemented and the majority of principals and coordinators reported their Teach First participant had a positive impact on teaching and learning in their school[13]. The Ministry of Education is supporting its further expansion.

The barrier to entry is high with only 7% of applicant's being accepted on to the programme. Since 2013, 74 candidates have qualified through Teach First. Half of Teach First New Zealand science and technology graduates say they would not otherwise have considered teaching as a career.[14]

• • • •

"One of the things that became clearer to us this year is the extent to which participants are being prepared as 21st century future-focussed teachers: they are confident about opening up their classrooms and their practice to ongoing scrutiny... they are fluent users of digital technology in teaching and learning..."

NZCER Evaluation of Teach First[15]

In 2017, Teach First NZ worked with Mind Lab in Auckland to develop a new teaching qualification to codify what it has been learning about preparing technologically savvy and future-oriented teachers.

(ii) Continuing Teacher Education

The Manaiakalani Digital Teaching Academy (MDTA) is a partnership between the University of Auckland, Google and Manaiakalani Education Trust[16]. Manaiakalani is a cluster of 12 schools in the poorest part of south Auckland. The Manaiakalani Trust was set up in 2011 to use digital technology to bridge and enrich learning in school and at home.

Piloted in 2013-2016 and now in its first full year, MDTA brings together newly qualified and experienced teachers as mentors to accelerate the skills development of the beginning teachers so that they can 'keep up' with the students in the Manaiakalani schools. Both groups of teachers are studying on Masters Programmes.

The programme grew out of a frustration that initial teacher education was not producing teachers with the necessary digital know-how or the pedagogical skills to make the most of

(9) http://www.unesco.org/fileadmin/MULTIMEDIA/HQ/ED/images/singapore.pdf

(10) http://www.curiousminds.nz

(11) https://nz.educationhq.com/news/33914/so-why-the-stem-push/

(12) https://teachfirstnz.org

(13) https://www.educationcounts.govt.nz/__data/assets/pdf_file/0017/181610/Final-Evaluation-Report-Teach-First-NZ-programme-pilot.pdf

(14) teachfirstnz.org/images/uploads/Documents/TFNZ_Impact_Infographic_FINAL.pdf

(15) https://teachfirstnz.org/stories/fourth-nzcer-independent-evaluation-report-released

(16) http://www.manaiakalani.org/home

technology for the benefit of student learning. Through the financial support of the Manaiakalani Education Trust, all students at cluster schools have access to a 1:1 digital device. The MDTA then coaches teachers in digital pedagogy to make best use of these tools. All teachers progressed successfully through the pilot to 2016 and the digital pedagogy, mentoring and induction practices are now being developed across the network.

During the final full year of the project (2015), children in 7 out of 10 cluster schools have made above expected progress in writing against national standards, and over or expected progress in reading and maths.[17]

4. Communities of learning to encourage the spread of ideas and to foster innovation

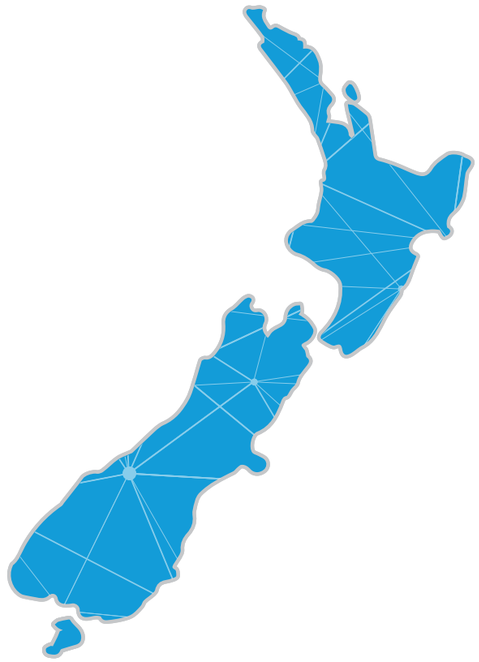
A Community of Learning is a group of education and training providers working together to help learners achieve their full potential. A community can include early childhood education services, schools, kura (Maori medium schools) and tertiary providers. Each Community of Learning shares goals, or achievement challenges based on the particular needs of its learners. Since 2015, 69 Communities have been approved and funded by the NZ Ministry of Education.[18]

This formal Ministry sponsored arrangement is new, but networking in New Zealand is a tried and tested approach to fostering and adopting innovation in schools.

Learning and Change Networks (LCN) were collaborations between schools, and their communities; partnerships designed to identify local challenges and make changes to improve student learning. In July 2014, there were 53 networks, comprised of 286 schools and kura, about 11% of the schools in New Zealand.[19]

The 'daughter' of Learning and Change Networks, Communities of Learning are not directed to or required to focus exclusively on STEM; although naturally some of them do, that is not their function. The Communities are a 'layer' in the New Zealand education system, connecting schools in self-identified communities of practice to develop and share new ideas and practice. They are part of the solution to scaling and diffusing innovation, and make it more likely that new approaches, including in the teaching of science and technology will be adopted.

NEW ZEALAND



(17) Manaiakalani Education Trust Evaluation of the 2015 school year. available at http://www.manaiakalani.org/our-story/research-evaluation

(18) https://education.govt.nz/ministry-of-education/col/

(19) OECD (2013), "The case study sites", in Innovative Learning Environments, OECD Publishing, Paris. http://dx.doi.org/10.1787/9789264203488-11-en

Brazil

Brazil is an enormous country measuring 8.5 million km^2 , comprising 27 states in 5 regions and inhabited by over 200 million people. There are 195,000 schools in Brazil serving 51.5 million students.[20]

In such a huge and diverse country, with federal, state and city administrations, it comes as no surprise to learn that there is no single education strategy in Brazil, but instead a complex landscape in which government, private sector edupreneurs and philanthropists are prosecuting different agendas, occasionally in collaboration, more often independently.

Approaches range between huge investment in technology and a commitment to 21st Century skills, to a relentless focus on 'the basics' of numeracy and literacy.

If there is any agreement at all, it is that Brazil must look to the future for ways to educate their young people and not to the past. Brazil hopes to avoid the 'mistakes' as they see them, of other developing nations who have adopted US or European style systems.

Instead the Brazilian narrative of emancipation — freedom from the past, from political oppression and poverty, and freedom to grow into a confident, modern, democratic society – translates into a more radical approach, in which Brazil plans to move straight to a 21st Century education system, untrammelled by the infrastructure and orthodoxies of 19th and 20th Century schools and systems we see around the world. The Brazilians call this 'leap-frogging', and ICT for learning is at the heart of what makes it possible.

Learning without teachers

In the 1990s and early 2000s, Brazil experienced massive economic and population growth, which fuelled an explosion in demand for high quality education, in particular for secondary age students. In a country where most adults have only a primary education if that, the challenge of meeting this demand is significant.

With content designed by some of the best and brightest teachers in Brazil, Educopedia[21] is an online platform for collaborative digital lessons, where students and teachers can access self-explanatory activities through play and practice, anywhere, anytime.

This 24/7 access makes it possible for schools to operate a half-day, split shift changeover, doubling the number of students they can accommodate.

It also helps teachers to manage larger class sizes and enables parents to engage in home learning with their children in better served areas and dramatically improves the quality of home learning in those less well served.

Part of the motivation for developing Educopedia was to even out inequalities in access to high quality teaching by making it possible to compensate for poor teaching and, in the most extreme cases, remove the need for teachers all together.

GENTE – a school that isn't a school[22]

However, one of the more inspiring purposes to which Educopedia has been put is as curriculum content in GENTE - Gimnasio Experimental de Novas Tecnologias Educacionais, which translates as the Experimental School of New Educational Technologies.

Not enough teachers is only part of the demand challenge facing Brazil – there simply

(20) GELP Brazil country profile 2014

(21) http://www.educopedia.com.br/

(22) Caldwell B. & Spinks J (2014) The Self-transforming School Routledge

aren't enough schools either and, as we have seen, Brazil has rejected the idea that they should build schools to the existing template. GENTE, a new model of 21st century learning being developed in Rio de Janeiro to help prepare students for the challenges of the modern world, offers an alternative. The fullest realisation of the GENTE model, GENTE André Urani, was developed in 2013 and serves students from grade 7-9.

Despite being situated in one of Rio's more dangerous favelas, Rocinha, GENTE breaks down classroom walls, literally and figuratively, to rethink what a school, the physical environment and the learning that happens in it should look like. So much of what we might traditionally expect to see in a school is absent or radically different.

There are no classes or year groups and students learn in large groups in converted space that was never designed to be a school. Each student joins with a formative itinerary, highlighting their individual pathway; a kind of personalised digital map that lists the skills and competencies they already have as well as those that they need to develop.

Students work, individually and in groups, on tablets and smartphones – there are no notebooks or textbooks – to access curriculum and run through online games and diagnostics that guide them through different learning levels.

Teachers are the guardians of personalized learning for each student. They are mentors, guiding students on their learning journey and supporting them to collaborate in multidisciplinary projects.

This alternative relationship in which the student is genuinely at the centre of the learning experience, with the teacher as 'guide on the side' reflects the values that underpin the GENTE model; that students are authors of their own life stories and need every opportunity to grow a sense of agency and control over their learning.

GENTE's results are so far good, but it is still small, serving fewer than 300 of Rio's 700,000 children. Plans for training teachers in the GENTE model are advanced, to enable the opportunity to be made more widely available. Moreover, it has become a site for improving ICT for learning options that could then be used in other schools. Through a partnership with Geekie Labs, a Sao Paulo-based start-up, it is providing a site to develop a digital high school curriculum: as students at the school work their way through the curriculum materials, the software is "learning" (through algorithms) how to improve the sequencing and guidance.[23]

The digital capabilities of GENTE André Urani have proved valuable in other unexpected ways. During periods of increased violence in the Rocinha, the school decided it was unsafe for students to be on site, but continued to communicate with them via Facebook, providing online activities and assessments that students could work through from their devices at home.[24]

A learning marketplace

Elsewhere, other ICT for learning start-ups are introducing new products and services into this diverse and high potential market.[25]

EvoBooks[26] specializes in electronic publishing supplying schools with digital books that can be constantly updated and which include 3D images and games that bring curriculum to life in new and exciting ways. Evobooks resources cover maths, the sciences, history and geography and are available offline once downloaded – important in a country with vastly variable broadband access, speeds and reliability. The EvoBooks platform was trialled in the GENTE schools. In this evaluation, students who made greatest use of the platform had gains almost a third higher than the average

(23) "How software that learns as it teaches is upgrading Brazilian education" The Guardian. 10 January 2016 https://www.theguardian.com/technology/2016/jan/10/geekie-educational-software-brazil-machine-learning

(24) https://www.facebook.com/gente.andreurani/

(25) https://atelier.bnpparibas/en/smart-city/article/edtech-brazil-huge-market

(26) http://www.programainspira.com.br/

BRAZIL

after four months.[27] In a separate quasi-experimental study carried out with 8th grade students in Colombia, researchers found that using a "virtual laboratory" on the EvoBook platform was as effective as using a real laboratory in terms of students' understandings of chemistry concepts.

Descomplica (translates as de-complicate or simplify) pays high fees to charismatic teachers from the best independent schools to engage and inspire students in video lessons. In many other ways like Khan Academy, this investment in securing the best teachers to deliver the online lessons is unique. Some of the "classes" take place live, allowing students to interact with teachers.

There are upwards of 4000 lessons in eight subject areas available from the platform, as well as access to personal tutoring, for a subscription of around $35 per year. The platform is aimed at students preparing for the ENEM, Brazil's high-stakes university entrance exams. While it is essentially glorified test-prep, the platform allows those from state schools to access the kind of teaching and preparation usually only accessible to their private-school counterparts. Two thirds of all student subscribers come from low-income families. In 2016, students who used the platform improved their score by an average of 106 points from their previous try.

EvoBooks and Descomplica are just two of many examples, but they are especially interesting as their success can be attributed in part at least to the fact that they build on existing opportunities and trends in Brazil. EvoBooks, was designed to make better use of whiteboards and tablets that were being gifted to schools by Governments and NGOs alike, with no real strategy for how they could or should be used effectively. Previously unutilized or underutilized resources are now animated by engaging content and in the hands of learners.

And Descomplica harnesses Brazilian enthusiasm for YouTube and Instagram and other social media platforms, which are huge in people's day-to-day lives but virtually absent in education.

(27) http://evobooks.education/research.html

Innovation Unit, Aga Khan Education Services and the Aga Khan Foundation were commissioned to complete this report by UNICEF Eastern and Southern Africa Regional Office and West and Central Regional Office.

For readers wishing to cite this document we suggest the following form: Innovation Unit, Aga Khan Education Services and the Aga Khan Foundation (2018) Raising Learning Outcomes: the opportunities and challenges of ICT for learning. UNICEF Eastern and Southern Africa Regional Office and West and Central Regional Office, Nairobi.

unicef
for every child

Innovation Unit
New solutions for thriving societies

AGA KHAN FOUNDATION

Aga Khan Education Services