Christ Church Grammar School

Headmaster's Report

May 2015

Attachments

- Protection racket - The Unacceptable Cost of Deception in the War Against Non-Government Schools
- STEM Skills in the Workforce
- New Vision for Education – Unlocking the Potential of Technology
- IBSC 2015 Australia New Zealand Regional Conference
- Media clips

Old Boys' Association
Parents' Association

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FROM THE HEADMASTER'S DESK

The beginning of the term started well and that is reflected in the body of this report.

The term break in April saw me take the opportunity to visit Bond University as a Principal in Residence. The schedule for that visit was made available at the previous Council meeting. I will report on this experience toward the end of the year when it is concluded.

I also took the opportunity to attend the IBSC Australian and New Zealand Regional Conference at Churchie in Brisbane. The programme for this is attached. It was fortuitous that the theme of the Conference allowed our new Service in Action Director **Mr Mark Tait** to be imbedded in focussed thinking at the very beginning of his tenure with regard to where service is in Schools of our type in the region.

Council will find attached to this two articles apposite to the visit of Dr Yong Zhao to the School in April. Also a very pertinent article on independent education from the editor of AHISA *Independence*.

Council will find included in their packages a copy of Creative Schools - Revolutionizing Education from the Ground Up by Ken Robinson and Lou Aronica. During my time as Headmaster I have used books as both provocation and thanks for staff within the School. Titles have included:

- Drive – The Surprising Truth About What Motivates Us by Daniel Pink
- David & Goliath – Underdogs, Mistfits and the Art of Battling Giants by Malcolm Gladwell
- Outliers – The Story of Success by Malcolm Gladwell
- Change – Learn to love it, learn to lead it by Richard Gerver
- id – The Quest for Identity in the 21st Century by Susan Greenfield
- Flourish – A Visionary New Understanding of Happiness and Well-being by Martin Seligman
- Five Minds for the Future by Howard Gardner

Given that the School is currently undergoing a strategic planning phase and we will at some point involve the staff as a component of our consultation I thought this particular title may be most appropriate for 2015.

STUDENTS

THE LW PARRY PREPARATORY SCHOOL

Academic

The 'Open Classrooms' were completed in the final week of Term 1. The Open Classroom provides the teachers to showcase their excellent work with the boys and their positive class environments. There was an exceptional level of parent engagement and participation.

Term 1 Mid-Semester reports were distributed via the parent portal. The report provides parents with a clear indication of their son's Term 1 achievement and progress. All reports in 2015 will be distributed via the portal, not sent by mail.

Pastoral Care, Planning and Co-curricular

On the Staff Professional Development day the Preparatory School held the first Christ Church Launchpad for boys commencing at the School in Year 4 in 2016. Children have had an increasing role in parent decision-making regarding school choice and commencement dates. **Mr Richard Wright**, believed if children were provided with a positive and enjoyable first experience at Christ Church they would be keen to commence in Year 4.

The first Launchpad was co-ordinated by **Mrs Maria Hodges**, Director of Pastoral Care, Planning and Co-curricular, and **Mr Brady Leckie**, Preparatory School Sportsmaster. The boys were engaged in a range of specialist activities and positive feedback has been received from boys and parents.

> Thanks Sarah! Just a note to say that [redacted] really enjoyed the launch day yesterday, and I received great feedback that he was very engaged with all the activities.
>
> Kind regards,
> [redacted]

A mini-Launchpad is planned for the Pre-Primary 2016 cohort for 3 July.

SENIOR SCHOOL

Academic

We are about to embark on a wide-sweeping review of the operations of the Peter Moyes Centre, both in the preparatory and senior schools. The review will be conducted by a previous consultant at AISWA, **Ms Kylie Bice**, and we are confident that it will enable us to build on our strengths and address the areas that can be improved. The report will be ready at the end of Term 2.

Heads of Department have been observing lessons taught by each member of their staff and **Mrs Margaret Brophy**, Director of Studies, has in turn observed each Head of Department. The subsequent feedback discussions have been provocative but affirming and the process has been very worthwhile. Allwell data has been received for both Years 7 and 10 and we are considering what aspects of this will be disseminated with the assistance of the School Psychologist. We now await the arrival of OLNA results for relevant Year 10 and Year 11 students.

The Academic Committee has been reviewing Australian Curriculum curriculum compliance and judging standards as we are now required to report to parents twice a year on Phase 1 subjects. Our review of the Year 11 and 12 boys' Term 1 reports has been helpful in monitoring performance.

Pastoral

Mr Michael Masterton, has taken up the reins of Moyes House. Another pastoral focus for this term rests with the Assistant Heads of House who oversee the Peer Support program. They are examining a range of proposals to extend the involvement of the Peer Support leaders throughout the year. The other primary pastoral focus is on the Year 11 and 12 students who will be undertaking their mid-year examinations, participating in a competitive sporting program and enjoying the glamour of the school ball in the weeks ahead. The importance of keeping all of these commitments in order and maintaining a healthy balance of work and rest are central to ensuring successful outcomes. The House Arts competition continues to engage a large number of boys from all year levels in chess, debating and public speaking and certainly raises the profile of these activities at a school level.

Planning and Co-curricular

Two boys have spent the term away from CCGS on the Beyond Queenslea Drive programme. Both these boys spent a term at TIHOI Outdoor School (St Paul's College NZ). They have by all accounts had tremendous experiences that will benefit them in the years ahead.

This term we have boys at the following schools for varying stays. Two boys go to St. Jean a La Croix in France, two at St Christopher's in the USA, two boys to Tonbridge School in the UK and one at Huijia School in Beijing. Also three boys are in South Africa, two at Michaelhouse and one at Bishops School. We also welcome two boys from Michaelhouse for the term.

The 'social season' starts next week with the Year 12 Headmaster's Dinner on Wednesday and the Year 12 Ball at the Hyatt Hotel in Perth on Saturday. The following weekend sees the Year 10 Social and the Year 11 Dance, both in the school gym.

Tours

The end of first term saw a range of cultural, sporting and service tours depart to a range of Australian and overseas destinations.

A senior rowing group competed in the national School Boys rowing championships in NSW and returned with a credible second position in the Schoolboy coxed fours.

Unfortunately the first SIA trip for 2015, to the Burringurrah Community in the Gasgoyne, was cancelled because of extreme rainfall from cyclones. These boys will now be split between the Looma and Marble Bar trips later in the year.

Twelve boys and two staff, along with a total of nine girls and 2 staff from MLC spent 2 weeks in China. For part of the tour they were hosted by Huijia School and another week was spent in Beijing seeing the sights. We are looking forward to hosting a group of Huijia students and staff later in the year.

SIA Fiji again returned to Fiji for their annual service trip to assist at the orphanage and surrounding community. In all, a dozen boys and a similar number of St Hildas girls visited, along with two CCGS staff, **Mrs Jane Shannon** and **Mr Allan Hallett**. This tour is now in the 9th year.

A group of eighteen boys and two staff visited New York on the Art Tour. This was a fantastic tour, which experienced the bustle of New York, rich in its Artistic and business culture. Visits to famous Art exhibitions and workshops highlighted the experience along with the bright

lights. This tour was led by Head of Art Department, **Mrs Pam Yordanoff** with **Mr Jean-Marc Rivalland**.

Sport
Over the holiday period there has been a hive of activity around preparation for winter season. There have been numerous practice matches in the senior codes. Certainly the hockey fraternity is excited about their training and fixture on the new artificial turf at UWA.

The first round fixtures against Wesley start this week for both Senior and Preparatory Schools.

Arts
The Drama Department has been busy with rehearsals for the Year 9/10 play 'Teechers directed by **Mrs Nicky Garside**. The season opened last night and runs through until the 2 May, the season is sold out in the Drama Centre. Rehearsal for Assassins and Cloudstreet are also well underway. Assassins will play at the Subiaco Art Centre in mid May. It is a new initiative from MYTC, as it is a production involving mostly past students.

Outdoor Education
The Kooringal program in week 1 of Term 2 concluded the Year 7 Transition camps with Craigie and Hill Houses. Building trust and cooperation amongst the respective members of the House groups is a key focus. These transition camps bring together boys from both the Preparatory and other schools as House groups and seeks to begin the process of relationship building for the coming years.

Last weekend saw the first group of 38 Year 8 boys and 2 staff head towards Monkey Mia to board the STS Leeuwin for the first of five back-to-back Year 8 voyages.

STAFF

Teaching Staff

Appointments:

Mr Joseph Sterlini has been appointed as a part-time Physical Education Teacher in the Senior School. Joseph's most recent position was a Teacher of Mathematics and Physical Education at Langley Park School for Boys in London.

Mrs Julie Bosnich has been appointed as a Science Teacher in the Senior School. In recent years Julie has been a full-time carer to her children but has kept her teaching skills active through relief teaching and private tuition lessons to both primary and secondary students at John XXII College.

Ms Amy Smith (Commencing Tuesday 28 April – Week 2, T2)
Amy has been appointed as a Special Needs Teacher in the Senior School Peter Moyes Centre. Most recently she has worked as a School Psychologist in Geraldton and has a range of experience in Education Support setting.

Mr George Haggett (School Captain 2011)
George will join the School as a Non-Residential Community Assistant commencing this term. He has recently completed a Bachelor of Science at UWA and is currently working at Apollo Health.

Ms Keren Caple has been appointed as the Visitor to the Centre for Pedagogy. Keren currently works as a consultant focusing on: learning, teaching and leadership; professional learning; system change; strategic and policy planning and development.

Keren spent the last five years of her career working on improving and innovating teaching and leadership throughout Australia as General Manager of the Australian Institute of Teaching and School Leadership. This included leading the Learning Frontiers initiative where she has worked with communities of schools and design partners ('design hubs') to develop and test a set of design principles for engaging learning.

COMMUNITY AND ENGAGEMENT

Student Achievements

News stories for April 2015 include:

- *LaunchPad* experience for incoming Year 4 students
- 2015 Art Tour of New York
- Army Cadets represent Christ Church in Bankwest Gallipoli run
- Anzac Centenary Service
- Christ Church wins top spots in Have Sum Fun
- Summer sports season cup and trophy announcements
- Young performers tackle deadly characters in a musical not to be missed
- Year 6 boys impress while on Canberra Tour
- 2015 Summer Sport Champions
- Young performers tackle deadly characters in a musical not to be missed
- Lending a hand to Australian Doctors for Africa (ADFA)
- Christ Church tennis players are PSA champions
- Op Shop Chic

Community

The *Christ Church Connect*, The *Queenslea Club Quarterly* and *Old Boys'* Newsletters will all be delivered to their respective audiences before the end of April.

Parents Association and Auxiliary

The Parents' Association, together with the Old Boy's Association are currently progressing the annual Cocktail Party to be held on Saturday, 23 May. Council attending would be well received by the support groups.

Our new parent dinners and Year 6, 7 and 8 Sundowners were all well attended in Term 1.

Parents' Auxiliary – The 'New to Perth' group was recently started to assist new parents. Diane Mason, a parent new to Perth from the United Kingdom in 2014, has held coffee mornings and been in touch with all parents new to Perth in 2015.

Old Boys' Association

Activities

- Class of 1958 annual lunch held - 10 April
- Headmaster's dinner in Brisbane with old boys - 11 April
- ANZAC Centenary Service held at the School with old boy and guest speaker Major General Craig Williams (1974). The ceremony was followed by a morning tea – 23 April

The Old Boys Association April-May newsletter has been distributed.

Centre for Ethics

The Centre had a full schedule Term 1 with some outstanding speakers including Luke Ryan, who spoke about his cancer journey, titled *A funny thing happened on the way to chemo.* Professor Patrick McGorry, Australian of the Year 2010, presented to a group of more than 200 on *Hope and help for young people experiencing early signs of mental illness.*

Use of campus over Term 1 break
The following activities took part on the School's campus during Term 1 break:

- Football West Development Camp – Walters and Knutsford House
- ATARget WACE revision Courses – L and M block rooms
- ASC Sports Camps – Mt Claremont playing fields
- Friends of Royal Flying Doctor Service Bridge Day - Refectory

PHILANTHROPY
Annual Giving will be received in mailboxes this week for over 9,000 members of the Christ Church community. This years' campaign focuses on five priority project due for completion in the short – medium term. They are:

- Kooringal 'high ropes' course
- Peter Moyes Sensory Library – Preparatory School
- Electronic Scoreboard
- Scholarship Trust (ongoing)
- Indigenous Scholarship Fund – 2 additional scholarships (ongoing)

The main objectives of this years' Annual Giving are to recruit and retain donors to giving at Christ Church.

ICT

In order to fully utilise the April term break, ICT services planned for and engaged in several upgrade/review processes during April. The following highlights some of the activities conducted:

Synergetic

As described in the previous report the upgrade to version 66 introduced a number of issues with Synweb, the web interface to Synergetic. In an attempt to address some of these issues Synergetic was subsequently upgraded to version 66R1 and then to version 66R1 patch1. This version however also suffered from 3 critical bugs. These include missing icons, browser incompatibilities and access slowness.

During the term break a secondary patch was applied to address these three bugs.

Exchange Upgrade

On Thursday the 9 of April ICT Services commenced upgrading the schools staff email system. The Microsoft Exchange service was upgraded from version 2007 to version 2013. The last significant upgrade of the staff emailing server occurred in 2009 when the school moved away from FirstClass to Microsoft Exchange.

The new version provides CCGS with the following advantages:

1. Increased stability and integration properties;
2. Ability to easily migrate to the Microsoft 365 cloud when ready in the future;
3. An improved web interface to email.

Electronic Document Management Project

In 2014 ICT services worked closely with Fuji-Xerox and Synergetic to develop an electronic document ingestion system which integrated with Synergetic. The multifunction devices (MFDs or copiers) were also configured to be able to interpret barcodes and execute workflows which resulted in the creation of electronic documents ready for Synergetic integration.
In April this project was extended to target the ingestion of Human Resources staff records. Once organised the physical records could be placed into a copier (MFD) and scanned and ingested into Synergetic.

Upon the successful completion of this project ICT services will extend this service to areas such as invoice payment and authorisation, administration records and medical records.

GOVERNANCE/FINANCE/FACILITIES

Council

The School has received a preliminary report on the extent of the next phase of the Brockway Playing Field development.

The final draft of the Traffic Management Plan is almost complete. There is some concern expressed by the consultant that proposed changes at the Queenslea Drive/Stirling Highway intersection could negatively impact congestion in Queenslea Drive. **Mr Price** is currently clarifying the situation with the Town of Claremont.

Messrs Morrissy and **Price** have met with town planners, Roberts Day, to consider some preliminary work they have completed following the completion of a feature and topographical survey of Kooringal. These considerations will be presented to Council by **Mr Morrissy** in August/September 2015.

Finance

The School has contracted Deloitte to complete a formal review of the revenue cycle in July 2015.

Facilities

The Chapel project is progressing well. **Mr Coslani** and the architect continue to be happy with the progress achieved by the builder, Western Projects.

Protection racket

THE UNACCEPTABLE COST OF DECEPTION IN THE WAR AGAINST NON-GOVERNMENT SCHOOLS

LYNDAL WILSON

THERE ARE those with such a deep-seated antagonism to the very existence of non-government schools that the likelihood of reasoned public debate on education provision in Australia seems ever remote. Unfortunately, apart from a few notable exceptions, neither reason nor truth plays a strong part in the ongoing war against non-government schools. Instead, the weapon of choice is disinformation.

In the last 15 years some quite sophisticated and no doubt costly disinformation campaigns have been waged against non-government schools. Up until about seven years ago, most of these campaigns were linked to federal election campaigns; their aim appeared to be to persuade parliamentarians and those who vote for them that support for the education of students attending non-government schools was a crime against the nation.

With a war chest largely financed by the Australian Education Union, such campaigns were waged on multiple false fronts, for example: 'private schools create social and religious "enclaves" that undermine social cohesion'; 'private schools undermine Australia's democracy'; 'public schools are in danger of "residualisation"'; and that old chestnut, still to be found in letters to the editors of major metropolitan dailies, 'private schools are funded at the expense of public schools'.

Private schools were demonised as the root cause of inequitable outcomes in school education. Not only were they accused of draining the public purse, it was claimed that they used public money to seduce the best teachers out of public schools, and stole the best and brightest students away from public schools with lucrative scholarships.

Public vs private

As I have argued elsewhere[1], the choice of language for these campaigns is deliberate. The classification of schools as either 'public' or 'private' reflects far more than common usage: it is a means to obscure

dis·in·for·ma·tion

ˌdɪsɪnfəˈmeɪʃ(ə)n

Definition: False information that is given to people in order to make them believe something or to hide the truth.

Merriam-Webster Dictionary, http://www.merriam-webster.com/dictionary/disinformation

the distinction between the public purposes of schooling and the public institutions of schooling. Governments do not need to own schools to ensure all children have access to them, any more than local councils need to own garbage trucks to provide householders with rubbish removal services.

The terms 'public' and 'private' are not used to denote ownership, they are used to create and sustain division between 'us' (public and 'inclusive') and 'them' (private and 'exclusive').

Consider for a moment the effect of replacing the term 'public' with the descriptor 'schools owned by governments' and replacing 'private' with 'schools owned by community groups'. That's hardly likely to pit neighbour against neighbour, is it? A school owned by a community group sounds a little too much like something 'us' might want to be part of or, worse, deem to be a demonstration of the entrepreneurial effort that so often serves to invigorate democracies and economies.

So successful is the term 'public versus private', first in dividing the community and then in uniting the 'us' parties through the common purpose of being against 'them', that it is still used to define the ground of debate. It is a gift to media searching for headlines and grabs that will polarise opinion.

One of the quite clever tactics of campaigns in the 00s was to engage high profile or otherwise reputable 'advocates' or 'champions' for the underdog of public education in its fight for survival against the creeping cancer that was private

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education. Top education bureaucrats, professors of education, high profile media personalities and even an eminent scientist who had been Australian of the Year weighed in with opinions or concerns, none of which were backed by evidence.

It is a true mark of the success of these campaigns that they could propose and sustain the status of underdog for schools whose owners had access to multi-billion dollar budgets and were able to draw on communities of millions of people.

In the early 00s, the preoccupation with non-government schools as undermining social inclusion led to proposals that schools funding models should be linked to enrolment policies. The following is a good example of the tenor of the language used:

> Such approaches to funding might be adapted from the concept of resources taxes to limit toxic greenhouse gas emissions. The right to practise particular forms of exclusion could be purchased from the government, much as the right to certain levels of carbon gas emission . . . [2]

The introduction of the SES model to distribute federal general recurrent grants to 'toxic' non-government schools, which had the effect of delivering increased funding to the sector, drove self-styled public education advocates to even further extremes. Ideological bias among some education academics became more pronounced, with critical rigour discarded like a cumbersome garment in an undignified and muddy scramble to what was thought of as higher moral ground. Let me give you one example.

A Victorian research institute of otherwise high reputation published a paper on the SES model by a professor of education, also of otherwise high reputation. The professor was critical of the model and the funding it delivered to non-government schools because of the crudity of using postcodes as a measure to determine SES. A letter was duly sent protesting this fatal flow in the professor's argument. As anyone who had bothered to properly research the SES model should have known, student addresses were linked to Census Collection Districts, not postcodes. A Collection District contains only about 220 households. (The postcode area in which I live embraces over 14,000 people!) A letter came back in due course to say the institute would stand

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by the research as describing the SES model as based on postcodes rather than the far smaller and more homogenous Collection Districts was 'a matter of interpretation'.

This slippery hold on indisputable fact evident in the work of some academics meant that 'interpretations' about the nature and role of non-government schools spread like bindi weed in a suburban lawn; one academic paper referenced another academic paper and within five citations a sloppy opinion had become evidence. We can see this at play in advice to the Gillard Government's Review of Funding for Schooling (Gonski Review). Referencing published academic papers, some of the Panel's commissioned research reports maintained that non-government schools and/or the exercise of school choice explained the under-achievement of some students in government schools.

While these campaigns can boast some successful skirmishes, there was no ultimate victory. For all the effort expended and academic reputations tarnished, for all the no doubt several millions of dollars of teacher union funds that were spent, this war never produced anything of worth, certainly not in any classroom that I've ever heard of.

Unfortunately, this wasteful war continues and, in spite of fresh tactics, its most recent campaign continues to demonstrate its futility.

Hip pocket warfare

The current campaign is akin to a social marketing campaign. The old arguments about non-government schools undermining Australian democracy never really worked. It seems a lot of Australians thought

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that by choosing to educate their children in a non-government school they were actually exercising their democratic rights, and enrolments in independent schools continued to climb.

The new campaign is a sophisticated attempt to put a collar and leash on the highly subjective issue of value for money. Aimed straight at parents' hip pockets, so far it has managed to get a good run in the park. Of course, having the inside running helps enormously, as I shall explain.

Once parents choose to educate their child in a non-government school they lose eligibility for the same level of government support for their child's education that would be available if their child attended a government-owned school. While governments contribute some money on a per student basis, with the amount depending on the relative advantage of the school community, families have to bridge the gap by paying fees. The less governments contribute, the more parents have to pay.[3]

As we read in the press every time the Australian Scholarships Group issues its annual prompt to parents to invest in education savings plans, the cost of educating one or more children in non-government schools can account for a large chunk of a family's after-tax income. In stark contrast is the very low cost to families of educating their children in government-owned schools.

This cost differential is what gives legs to this particular dog of an argument, especially in the aftermath of the Global Financial Crisis. The body of the argument is the proposition that the 'products' are the same, usually expressed in terms of student academic achievement. I'll come to that shortly, but first let's deal with the hip pocket.

Pick-a-mug

It is essential for the success of the current campaign (I will call it 'Fido', for short) to have people think of government schools as 'free'. But of course, they are not free. Far from it. In 2012-13, collective recurrent expenditure on government schools by Australian, state and territory governments was worth $36.9 billion, with another $1.9 billion on top for capital expenditure. Nationally, the average per student

'The old arguments about non-government schools undermining Australian democracy never really worked.'

recurrent expenditure by governments for government-owned schools was $15,703.[4] Government schools are not 'free', but as the cost of educating students in them is largely borne by the entire community, there is no noticeable impact on individual pay packets.

Fido certainly finds it easy to neglect the taxpayer who foots the bill for public education. Instead, the campaign invites parents to imagine about other ways they might be spending those private school fees. Just in case their imaginations are exhausted from all that hard work to cover the cost of their children's education, Fido offers ready-made dreams.

One memorable example was given in an article published by *The Sydney Morning Herald*.[5] A former advertising executive, now public education advocate and media commentator, revealed that she and her husband, who lived on Sydney's lower North Shore, sent their two children to Mosman High School, saving an estimated $300,000 on private school fees:

> The girls got a fantastic education and we were free to use that money in other ways. We took them overseas – twice – we bought good computer technology, we got them great coaching when they needed it and we are now paying their HECS fees.

The savings also allowed the family to buy an 87-hectare country retreat.

Paying private school fees? You're a mug, growls Fido. (Given stories like the above, you could be forgiven for assuming it is the taxpayer who is the mug. And please don't accept the implication of this kind of spin, that when it comes to schools, government schools are perceived simply as the best option to increase personal financial capital at the expense of the taxpayer. Many parents buy real estate or rent in the catchment zones of their preferred government school to ensure their child's

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enrolment, and attending the local school is a major factor for some families, especially in the primary years.)

Mentions of individual public schools in the Fido campaign are relatively rare. For the campaign to be successful, it must encourage parents to think about public schools in general, not in the particular, because schools are all very different and, in spite of the fact that government schools within each state and territory have the same owner, there is tremendous diversity among them.

Just to put the above example of school choice in the context of that diversity, according to My School, Mosman High School has an ICSEA score of 1149 (that is, it is a high-advantage school); 65 per cent of its 1030 students are in the top quartile of the ICSEA spread and only one per cent in the lowest quartile. Per student net recurrent expenditure in 2013 was only $11,898 (considerably lower than the NSW in-school per student average for secondary schools of $16,346) but, significantly, this figure reflects $1.16 million that was raised that year from fees, charges and parent contributions.

In contrast, the public high school where the family has their country property has an ICSEA score of 965 and only nine per cent of 660 students are in the top quartile of the ICSEA spread; 45 per cent are in the lowest quartile. The gap in school mean scores for Year 9 achievement averaged across the five NAPLAN domains was 61 points, in favour of Mosman High School.

Per student expenditure at the country school was $13,959, with an impressive $395,873 raised from fees, charges and parent contributions. Very generous considering the high proportion of students from low-SES families, but then of course these parents don't have the same demands on their pockets as do jetsetting city dwellers purchasing a country retreat; they already live in the country.

Performance propaganda

The main message of the Fido campaign is that given the choice between two similar products, one 'free' and one that involves personal expenditure, you'd have to be pretty silly to fork out your money. Brushing aside incidental differences such as co-curriculum, pastoral care and facilities, not to mention school climate – but lingering a moment to play with the 'old school tie' or 'networks' – the campaign fearlessly delivers its favourite tagline: 'There is no difference in performance between public and private schools'. Look at Fido's tail wag! Hear Fido bark! 'The evidence proves it!' Woof!

After more than a decade watching the antics of the public education lobby, use of the term 'evidence' by its warriors puts me on guard. Evidence? Or just more 'interpretation'? Whatever it is, I would recommend circling it at a distance and sniffing carefully before approaching.

What the excited Fido is pointing to – one front leg raised, neck stretched and tail extended – is comprised mostly of analysis of NAPLAN data. Some of this analysis has been undertaken by academics, some by former government school principals and some by the media. All of them recognise a large gap in the raw mean scores of independent schools and government schools across the five NAPLAN domains (reading, writing, spelling, grammar and punctuation and numeracy). All attempt to explain the gap away by either the socioeconomic background (SES) of the students or the schools, the family characteristics of the students or the prior achievement or 'general ability' of the students. In other words, they argue that independent schools do well – that is, their students get high marks in NAPLAN – not because of anything the schools do, but because of the characteristics of the students they enrol.

I am not an academic, I have no background in statistics, and I have no way of checking the data, but I would be prepared to accept the findings in at least some of the research on NAPLAN data. I know there are severe limitations to the NAPLAN testing and what it tells us about how children are faring at school, but even so, students are sitting the same tests; the narrowness of NAPLAN data is not a good reason to dismiss all the stories the data tell.

The problem, it seems to me, is not always with the findings (although the factors analysed are often limited), but with the way they are described and the use to which they are put. There are some notable exceptions, but bear with me while I work through a few examples to illustrate the point.

‘Analysis of NAPLAN data from Years 7 to 9 compared to Years 3 and 5 suggests the effect of schools on student learning may be cumulative.’

Bias and misrepresentation

Recent analysis of Year 3 and 5 NAPLAN results married to the Longitudinal Study of Australian Children (LSAC) data found no evidence that independent schools affect student achievement after accounting for a range of student and family characteristics.[6]

On release of the analysis, the media launched into blanket conclusions about the value of the education on offer in non-government schools. For example, Brisbane’s *The Courier Mail* proclaimed in its headline, ‘No benefit in private schooling: Queensland study’. On its website, ABC’s AM radio program ran a headline to their coverage which read, ‘Study suggests mums working to pay kids' private school fees should stay at home and use public schools instead’. The ABC’s PM program was more restrained: ‘No academic advantage gained in private schools: research’. *The Australian’s* headline ran, ‘‘Private schools “perform no better”’. They’re big claims to promote about analysis that reaches only to Year 5; most people think of schooling as a developmental experience of possibly 12 years’ duration.

Which points to one of the most dissatisfying aspects of the way much of the NAPLAN research is interpreted – when it comes to determining differences in school ‘value adding’, are two-year or four- year timeframes sufficient to determine school effects on student learning, especially in the primary years? Analysis of NAPLAN data from Years 7 to 9 compared to Years 3 and 5 suggests the effect of schools on student learning may be cumulative. At the very least, it suggests schools can help to overcome any disadvantages inherited from families and their circumstances.

Late in 2014 *The Australian* published its own analysis of NAPLAN data. While no information was given that allows for a judgment to be made about the breadth of the data or the accuracy of its analysis, I offer it here for consideration because it does allow a comparison between a measure of school performance from Year 3 to Year 5 against Year 7 to 9. At the same time it is also a good example of how media reporting can bury otherwise important information under ‘interpretation’.

The Australian’s analysis classified schools into four categories based on student gain between Years 3 and 5 and between Years 7 and 9, as measured against the average progress of all students:

- schools with low-scoring students making little progress were designated as ‘low-performing schools’
- schools with low-scoring students who were advancing more quickly than expected were designated as ‘improving schools’
- schools with high-scoring students who showed little improvement above expected levels were designated as ‘coasting schools’
- schools with high-scoring students who were also improving above the average gain of all students were designated as ‘successful schools’.

I have taken *The Australian’s* findings and illustrated them in Charts 1 and 2. Note that students in schools deemed as ‘coasting’ or ‘successful’ are still achieving high scores. (The charts are published at size on the following page, so they are easier to compare.)

The Australian published its NAPLAN research on 9 December 2014, under the heading, ‘High scores hide schools’ failure to improve’. That certainly stopped readers focusing on the fact that in Year 5 60 per cent and upwards of non-government schools had high-scoring students, irrespective of whether the students were progressing at above average rates. In Year 9, 70 per cent and upwards of non-government schools had high scoring students.

Even according to *The Australian’s* own analysis, the proportion of ‘successful’ non-government schools – that is, schools with high-scoring students who were

Charts on page 7; text continues page 8.

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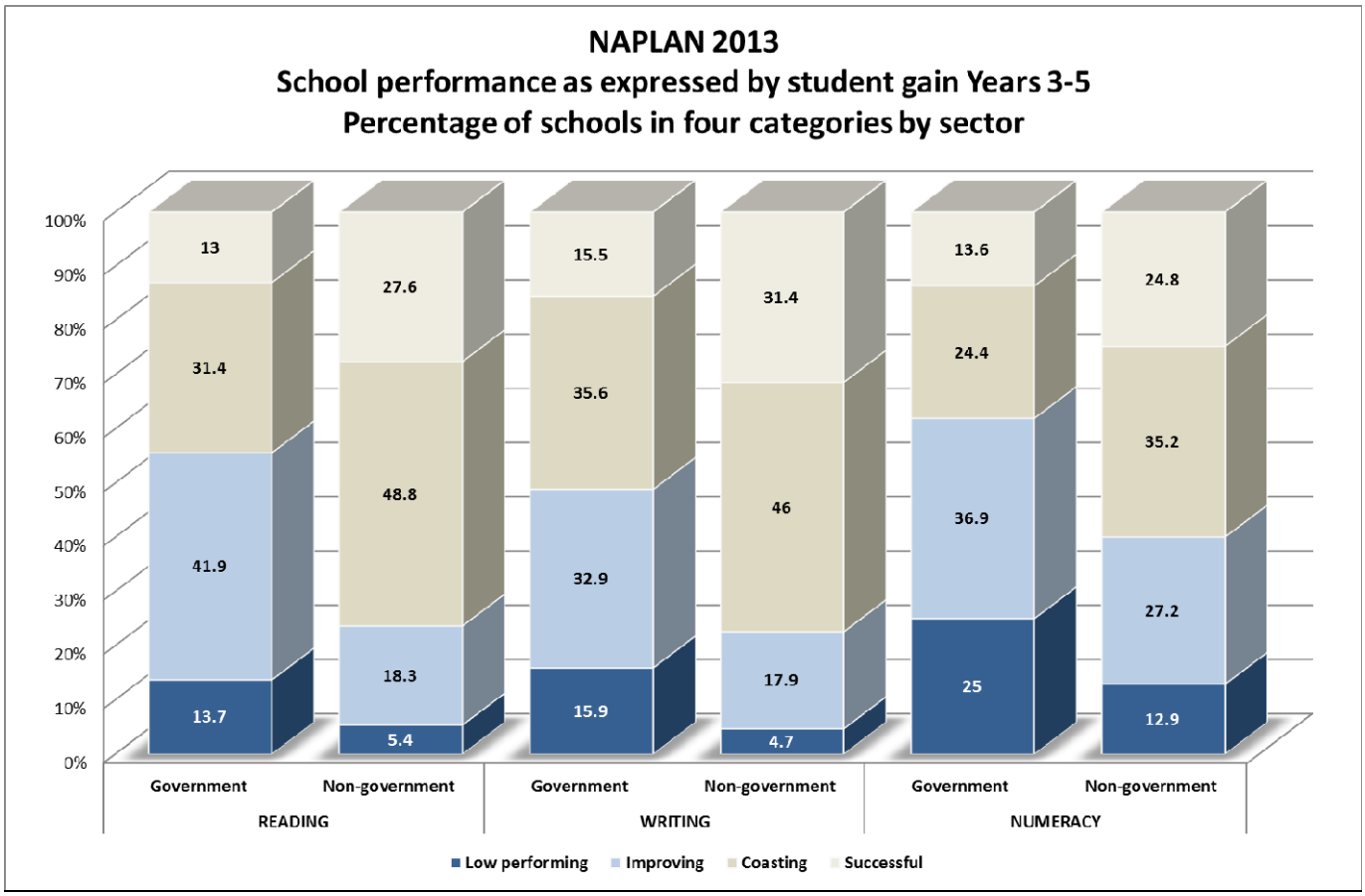

CHART 1. NAPLAN 2013: Years 3-5: Data as published by *The Australian*, 9 December 2014; chart presentation by Lyndal Wilson.

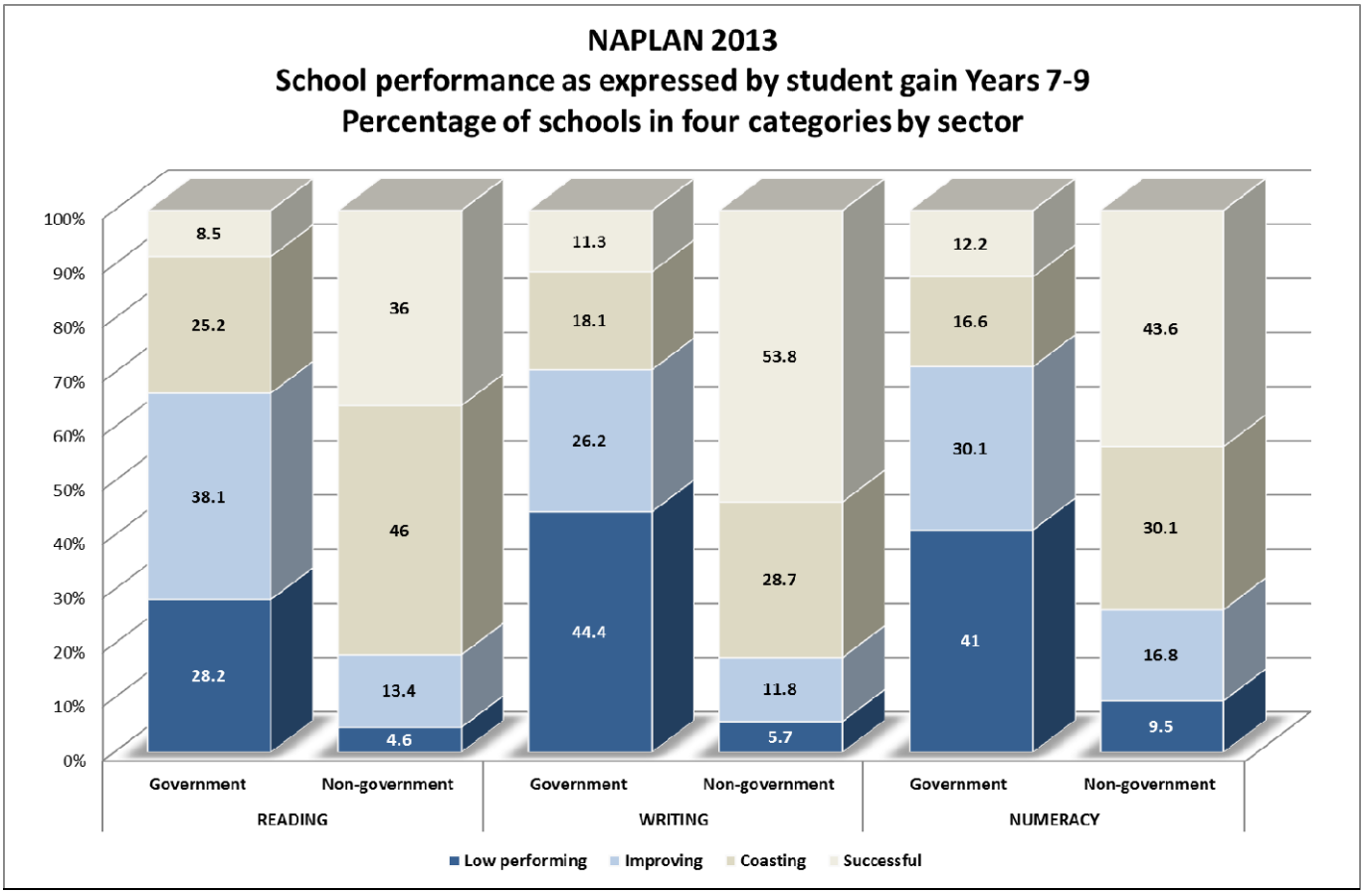

CHART 2. NAPLAN 2013: Years 7-9: Data as published by *The Australian*, 9 December 2014; chart presentation by Lyndal Wilson.

Note the increase in the proportion of high-scoring students in non-government schools by Year 9 and the significant increase in the proportion of non-governments schools classified as 'successful'.

Text continued from page 6.

also demonstrating above average gain – is remarkable. Yet these are the opening paragraphs of the paper's page one article:

> The focus on high test scores is masking the failure of schools to improve their students' learning, with a substantial proportion of fee-charging private schools 'coasting' on their high-achieving students, who make little progress.
>
> Analysis of national literacy and numeracy test results shows about 40 per cent of private primary schools and 35 per cent of private secondary schools are coasting, looking good with high test results but failing to record significant improvement in student scores.

It is not until many paragraphs later, in the continuation of the story on page two, that the high performance of non-government schools rates a (small) mention.

Startling as this evidence of media bias is, let's not ignore the interesting aspects of the data. Notice the significant jump in the proportion of non-government schools deemed 'successful' according to Years 7-9 data compared to Years 3-5 data. This is important. It may be possible to dismiss the high scores of non-government schools as merely a reflection of student SES or prior student achievement, but gains beyond those predicted by prior achievement cannot be explained away in this manner.

Note also that the proportion of 'successful' government schools shrinks. I can hear Fido howling that this is simply the effect of private schools stealing away all the high performing students from public schools with lucrative scholarships. The relatively small proportion of students on scholarships could not possibly explain either the increase in 'successful' non-government schools or the decrease in 'successful' government schools.

Of course, many children change schools at Year 7 and so this analysis does not necessarily support the notion of a cumulative school effect, but clearly something is going on, and it might just be 'value adding'. Surely the fact that non-government schools are clearly able to get enough students improving above expectations and thereby shift their rating from 'coasting' to 'successful' makes whatever they are doing worthy of investigation.

'Surely the fact that non-government schools are clearly able to get enough students improving above expectations and thereby shift their rating from 'coasting' to 'successful' makes whatever they are doing worthy of investigation.'

There is some overseas research that I believe sheds some much needed light into why non-government schools obtain these results, but let me press the 'pause' button for a quick word on the official country analysis of Australia's PISA results, as undertaken by the Australian Council for Educational Research (ACER).

Statistics and damned lies

Results of the OECD's Programme for International Student Assessment (PISA) and the associated ranking of participating countries and economies carry such weight that some nations are prepared to build their education policies around them. Australia's country report is therefore a serious document.

Since 2009, the reporting of Australia's PISA results has included some analysis by school sector – government, Catholic and independent. ACER's PISA 2009 and 2012 country reports both noted significant gaps in the raw mean scores between schools in the different sectors, and in the proportions of students in the different achievement percentiles. Both reports work very hard to minimise these differences. For example, in ACER's PISA 2009 report[7], the fact that 25 per cent of students in independent schools achieving in mathematical literacy at the highest proficiency levels of 5 and 6 (against 14 per cent of students in government schools) was attributed to 'most' independent schools being 'selective in terms of academic achievement'. Whether a gross error or just an

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unhappy choice of phrasing, fortunately this misleading explanation was not repeated in the PISA 2012 report.

The PISA 2012 Australia country report does however sustain the spin cycle in the data wash. For example, the wider spread of scores between the 95th and 5th percentiles in mathematical literacy for government schools is explained as indicative that 'government schools cater for students with a broader range of abilities than do Catholic or independent schools' (page 34). Yet the 2009 results for mathematical literacy showed that South Australia had the narrowest spread of scores in Australia. The ACT had the second highest spread after the Northern Territory. This would seem to support the interpretation of narrower spread as an indicator of greater equity in educational attainment. It is certainly an explanation used in other research, but apparently not in Australia's PISA analysis, or at least not when school sector is involved.

In both the 2009 and 2012 reports the raw achievement gaps favouring Catholic and independent schools are explained away as reflecting the SES of students and the SES of schools (as measured by a composite of various parental and home characteristics). Allowing for both student and school SES enabled the ACER to conclude that 'the differences in performance across school sectors are not significant'.[8]

There are many studies noting a stronger correlation between school SES and student achievement than between individual student SES and achievement, and the two effects are often compared. But it is only in OECD literature that I can find mention of them being combined, and then only obliquely. In PISA the SES of the school is determined as an average of the combined SES scores of those students in the school sitting the tests – up to 35 students per school, so to merge both effects seems akin to putting one slice of bread on a plate, turning it over and then claiming that a piece of bread with two sides is therefore the equivalent of a sandwich.

Even though an imaginary sandwich is poor fare, anti-private school campaigners continue to dine out on the ACER's conclusion that there are no sector differences in school performances.

TABLE 1. Raw Australian sectoral scores displayed against raw country rankings.

PISA 2012: COMPARISON OF RAW MEAN SCORES

READING LITERACY: Comparison of mean scores

COUNTRY/ECONOMY	MEAN SCORE	COUNTRY RANK
Shanghai-China	570	1
Australia - Independent sector mean	**551**	**(2)**
Hong Kong-China	545	2
Singapore	542	3
Japan	538	4
Korea	536	5
Finland	524	6
Australia - Catholic sector mean	**523**	**(7)**
Australia - Country mean	**512**	**14**
OECD average	**496**	
Australia - Government sector mean	**495**	**(26)**

SCIENTIFIC LITERACY: Comparison of mean scores

COUNTRY/ECONOMY	MEAN SCORE	COUNTRY RANK
Shanghai-China	580	1
Australia - Independent sector mean	**559**	**(2)**
Hong Kong-China	555	2
Singapore	551	3
Japan	547	4
Finland	545	5
Estonia	541	6
Korea	538	7
Australia - Catholic sector mean	**532**	**(8)**
Australia - country mean	**521**	**16**
Australia - Government sector mean	**506**	**(23)**
OECD average	**501**	

MATHEMATICAL LITERACY: Comparison of mean scores

COUNTRY/ECONOMY	MEAN SCORE	COUNTRY RANK
Shanghai-China	613	1
Singapore	573	2
Hong Kong-China	561	3
Chinese Taipei	560	4
Korea	554	5
Australia - Independent sector mean	**541**	**(6)**
Australia - Catholic sector mean	**514**	**(16)**
Australia - Country mean	**504**	**19**
OECD average	**494**	
Australia - Government sector mean	**489**	**(30)**

SOURCES: OECD (2013) *PISA 2012 results: Excellence through equity - giving every student the chance to succeed* (Vol 2); Australian sectoral data from http://www.acer.edu.au/ozpisa/the-australian-pisa-data-files.

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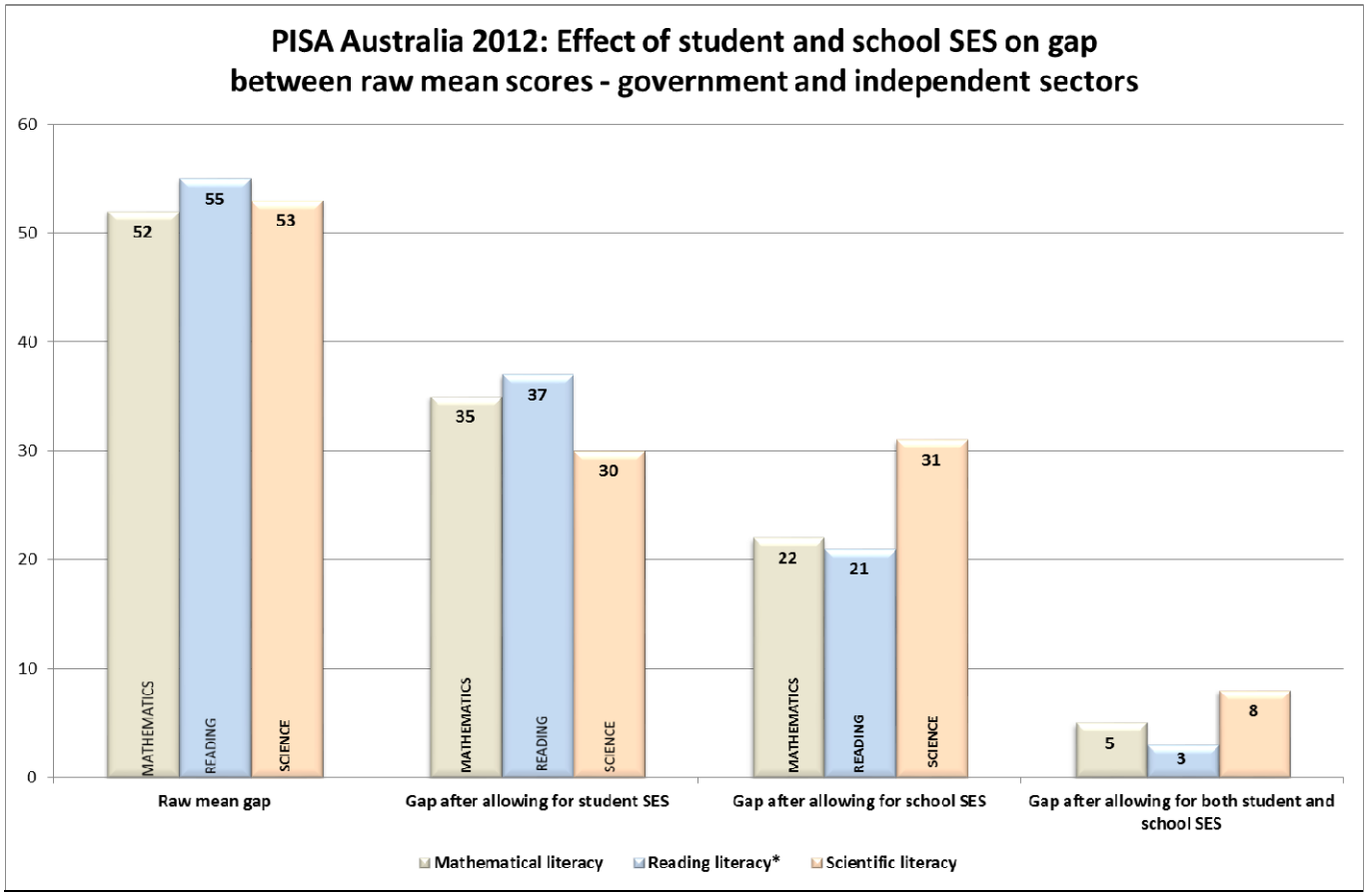

CHART 3. PISA 2012: Australia: The difference in raw mean scores between the government and independent sectors and the effect of allowing for student and/or school SES.

*In its country report ACER notes the difference as 55 although in other representations of sector raw scores the gap is 56.

Table 1 on the previous page shows the raw mean score results by sector for Australia in PISA 2012, expressed for interest's sake against the rankings for countries and economies. As you can see, and as the Australia country report notes before its SES discounting frenzy, the gaps in raw means scores by sector are significant. In Chart 3, I've shown the effects of accounting for student SES and school SES on the gap in raw scores as separate effects, which is more typical of other school achievement and equity research analysis.[9] I've also included the ACER double dip, although it seems counter intuitive. The gap remaining after allowing for either student SES or school SES, but not both, aligns far better with what is evidenced in the Year 7-9 NAPLAN analysis above. It also helps explain what comes next: the incontrovertible, indisputable and undeniable evidence of value adding by independent schools from Year 9 to Year 12.

Yes, schools do make a difference

Some of the evidence pointing to the value adding of independent schools has already been covered in AHISA's journal.[10]

To summarise, analyses of PISA data and Year 9 NAPLAN data (and previous literacy and numeracy testing conducted as part of the Longitudinal Survey of Australian Youth) against Year 12 achievement and tertiary entrance scores all show conclusively that, by Year 12, students in independent schools achieve at a level beyond that expected by prior performance. The 'value add' is significant, representing between 6 and 8 percentiles in tertiary entrance rank – *after* allowing for both student SES and prior achievement. The finding is consistent across datasets and across time.

The value add is greatest for students whose prior achievement is the weakest. For some, this would be another indicator of equity in academic achievement in non-government schools. But not for Fido. The Fido campaign ignores the already substantial and growing body of research on value adding in independent schools and instead tries to distract parents with loud barking about research studies showing that students from independent schools do not perform as well at university as students from government schools. According to Fido, that

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independent schools are able to achieve better outcomes for all students, not just some, has nothing to do with equity and more to do with 'nannying'.

While there is evidence that students educated in independent schools achieve (slightly) lower results than expected in their first year at university, there is no evidence but only conjecture as to why.

About a decade or so ago, when some Western Australian analysis on first-year university academic achievement according to school attended was released, I telephoned one of the researchers to ask if his study offered any explanation for the apparent under-achievement. Again, there was no evidence, but he commented that he suspected students from independent schools continued their heavy engagement in extra-curricular activities such as inter-collegiate competitive sports, debating and theatre, which were less regulated in the university environment and could be more demanding on students' time. (The word 'partying' was not mentioned.)

Certainly 'nannying' is not the answer. Analysis of data collected for the Household, Income and Labour Dynamics in Australia (HILDA) Survey shows students who attended independent schools are 2.8 times more likely to complete a university degree than students who attended government schools after allowing for the effect of parents' education. Further, attendance at a non-government school increases the odds of graduating from a Go8 research-intensive university (x1.576) or graduating with medicine or law degree (x1.524). Students who attended a non-government school are also 1.4 times more likely to complete a post-graduate degree.[11] The HILDA data suggests resilience and 'stickability' can be learned just as well in non-government schools as in the alleged 'toughening-up' environments of government schools.

Academic optimism

One thing that comes through very strongly from these data is that overall, if their children have completed Year 12 in an independent school, then parents can be confident their offspring will have achieved as well as they possibly could and more than might otherwise have been expected. Further, they will have gained a significant advantage for their tertiary studies. For many parents, that confidence is worth the spend.

'It is academic environment or "academic press" that is the most statistically significant factor that can be determined for the effect of independent schools, not only on the tertiary entrance scores of their students, but on the higher probability of their students transitioning to university.'

Rather than ignore these results, as Fido would have us do, surely they invite further investigation as to why independent schools perform so well and whether their success can be replicated.

As mentioned in the *Independence* articles already cited, Australian research evidence suggests that it is academic environment or 'academic press' that is the most statistically significant factor that can be determined for the effect of independent schools, not only on the tertiary entrance scores of their students, but on the higher probability of their students transitioning to university.

Various other studies mention a range of school variables that can be measured as affecting student achievement, such as student retention, stability of the school's student population, depth of academic offerings and 'school climate', which includes disciplinary climate, student engagement and teachers' expectations of students. All of these sit neatly with factors parents cite as influencing their choice of school for their children.[12]

However, none of these factors, important as they all are, seems to capture the vitality so apparent in independent schools or their tangible but difficult to measure 'ethos'.

Bryk, Lee and Holland, in seeking to explain the positive effect of Catholic schools in the United States on student achievement[13], found that valuing and promotion of community, the conviction that all

students can learn, school autonomy, and theology as a uniting principle were the key factors explaining this effect. (Flecks of frothy spittle are appearing around Fido's mouth. Did I mention that Fido is an atheist?)

More recent research, conducted in public schools in the United States, provides further insight the effect of school ethos.[14] According to this research, there are three school characteristics that are apparent in making a difference to student achievement after allowing for student SES and prior student achievement: the academic emphasis of the school, the collective efficacy of teachers (that is, 'the judgment of teachers that the faculty as a whole can organise and execute the actions required to have positive effects on students') and teachers' trust in parents and students. These characteristics are tightly interwoven and their combined effect is described by the researchers as 'academic optimism'.

In capturing the affective as well as academic and structural characteristics of schools, this research suggests why it is that parents remain happy with their choice of non-government schools despite Fido's attempts to undermine their confidence: it is almost impossible for outright lies, disinformation or marketing spin to undermine trust when the evidence of happy, engaged, challenged students, performing at their best, assures parents their trust is well placed.

The real story

The ghastly truth is that the war against non-government schools is a civil war. It pits neighbour against neighbour and undermines the collegiality of the teaching profession. Worse, the preoccupation with non-government schools has served to mask and therefore failed to address under-performance in the government sector. Fido is the government school owner's best friend.

Just why advocates of public education and the media they feed choose to put the boot into non-government schools rather than kick state and territory governments into action to improve their schools is a mystery. Why spend so much energy trying to 'disappear' the gains of independent schools when surely those gains are useful evidence that too many students in government schools are being left to languish in under-achievement? No doubt Fido would snarl that the higher achievement of some comes at the expense of the under-achievement of others. But that is a false correlation.

The high performance of non-government schools is a weak and silly excuse to offer for the under-performance of government schools, roughly equivalent to 'Fido ate my homework'. Only the gullible would believe it. And no one who wants every young Australian to have the opportunity to do their best at school should accept it. ■

Lyndal Wilson is Editor of AHISA's journal, *Independence*. The opinions expressed in her essay are not necessarily those of AHISA.

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[1] Wilson L (2003) Religious schools and Australian democracy. *Independence*, 28(2):25-28; Wilson, L (2004) Non-government schools are good for democracy in Australia. *Online Opinion*, 5 April 2004. Accessed at http://www.onlineopinion.com.au/view.asp?article=2116.

[2] 'Schools in Australia: A Hard Act to Follow' in *School resourcing: Models and practices in changing times*. Australian College of Education Year Book 2000; page 74.

[3] An overview of how non-government schools are funded can be found in 'The school funding partnership', *Independent Update*, Issue 9, 2014, published by the Independent Schools Council of Australia at http://isca.edu.au/wp-content/uploads/2011/07/Independent-Update-Issue-9-2014-The-School-Funding-Partnership.pdf.

[4] Productivity Commission (2015) Report on Government Services 2015. Accessed at http://www.pc.gov.au/research/recurring/report-on-government-services/2015/childcare-education-and-training/school-education.

[5] Elliott T (2011) Private v public – an educated guess. *The Sydney Morning Herald*, 13 April 2011. Accessed at http://www.smh.com.au/money/private-v-public--an-educated-guess-20110412-1dbok.html.

[6] Nghiem HS, Nguyen HT, Khanam R & Connelly LB (2015) Does school type affect cognitive and non-cognitive development in children? Evidence from Australian primary schools. *Labour Economics*, April 2015, 33:55-65.

[7] Thomson S, De Bortoli L, Nicholas M, Hillman K & Buckley S (2011) *Challenges for Australian education: Results from PISA 2009*. Melbourne, Australia: ACER; page 188.

[8] See for example the 2012 Australia country report, Thomson S, De Bortoli L & Buckley S (2013) *PISA 2012: How Australia measures up*. Melbourne, Australia: ACER; pages 34-35.

[9] As discussed by Dr Gary Marks in his article in the May 2015 issue of *Independence* (in press), some researchers argue that school-level SES is a 'statistical artefact' and cannot be used to explain sector differences. Dr Marks argues that prior achievement is a better predictor of student achievement than student SES or school SES. PISA measures student achievement at a single point in time and therefore does not account for prior achievement. I am not qualified to argue the research methodology; my main purpose is to query some of the interpretation brought to bear on the data.

[10] See Marks G (2015, in press) Students, schools and socioeconomic background. *Independence* 40(1):4-12. Plus data compiled for *Independence* 39(1):16, 'Data check: Independent schools do make a difference'. See also Wilson L (2003) op. cit., which cites Australian research indicating that students in independent schools are more likely to undertake volunteering and have higher levels of school engagement (which has been linked to civic engagement).

[11] Chesters J (2014) The Australian education system: Why expansion has not alleviated inequality in opportunities and outcomes. Seminar presentation, ANZSOG Institute for Governance (ANZSIG), February 2014. Accessed at http://www.governanceinstitute.edu.au/magma/media/upload/ckeditor/files/Chesters%20ANZSIG%20feb2014.pdf.

[12] Recent research on parents' perceptions of independent schools and reasons for choosing independent schools, undertaken by Independent Schools Queensland, is summarised in 'Data Check: Parental perceptions of independent schools' in *Independence* 40 (1):10, in press.

[13] Bryk AS, Lee VE & Holland PB (1995) *Catholic schools and the common good*. Cambridge, USA: Harvard University Press.

[14] Hoy WK, Tarter JC & Hoy AW (2006) Academic optimism of schools: A force for student achievement. *American Educational Research Journal*, 43(3):425-446.

Australian Government
Office of the Chief Scientist

OCCASIONAL PAPER SERIES

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STEM SKILLS IN THE WORKFORCE:
WHAT DO EMPLOYERS WANT?

*Roslyn Prinsley & Krisztian Baranyai**

Science, technology, engineering and mathematics (STEM) underpin Australia's potential to innovate and compete on the global stage - so are we ready to build the future we want?

KEY FINDINGS

Business and industry representatives have reported a shortage of STEM graduates. The Office of the Chief Scientist commissioned Deloitte Access Economics to survey employer attitudes to STEM skills and STEM skilled employees. Not all employers responded to every question.

- Of the 466 employers who responded to the question, 384 agreed that people with STEM qualifications are valuable to the workplace, even when their major field of study is not a prerequisite for their role.
- STEM employees were nominated as being among the most innovative by 345 of 486 employers.
- Of 451 employers, 241 expected their needs for STEM professionals to increase over the next five to ten years. 169 of 342 expect an increase in their needs for STEM-qualified technicians and trades people.
- Some employers experienced difficulty in hiring. Of 356 employers, 144 reported difficulty filling technician and trades worker roles, and 135 of 429 had difficulty recruiting STEM graduates. Around one in five reported a shortage of graduates. Around one in three reported a mismatch between the skills required and those of applicants.
- Employers valued work placements for preparing students to work. Only 140 of 502 employers currently offered structured placements.
- Many employers are not satisfied with their engagement with post-secondary education institutions.

BACKGROUND

This paper reports on the employer perceptions of STEM qualified people including the skills and attributes that they bring to the workplace, the value that employers place on STEM graduates, and expectations of future demand.

In Australia, 15 per cent of the working age population have a STEM qualification (Certificate III or above) and those numbers are rising. Between 2006 and 2011, the number of people in positions requiring STEM qualifications grew 1.5 times faster than all other occupation groups.[i]

The trend is not unique to Australia. Most modern economies in the world are working to harness the technological and innovation advantages that a STEM education can bring.[ii]

Is Australia developing a skilled and active STEM workforce ready to meet the challenges of growing a different economy?

AIM

The project aimed to understand:

- The skills and attributes that employers need from STEM graduates today and into the future.
- Whether employers are able to recruit workers with the STEM skills they require and if not why not.
- The extent to which employers are engaged and satisfied with education providers to train work-ready STEM students to meet their requirements.

METHOD

In 2013, Deloitte Access Economics carried out an online survey of employers. In total, 1,065 employers responded, representing 450,000 employees, across a range of industry sectors. Not all respondents answered all the questions in the survey and over half of employers did not specify the industry sector for their organisation. The response rate therefore varied between the survey questions. Response numbers are reported for each question.

A broad spectrum of industries and businesses was targeted. These either currently employed, or are looking to employ, staff with a STEM qualification, a sampling approach that may introduce a selection bias towards STEM-intensive firms.

RESULTS

Employer perceptions

Employer perceptions of their STEM qualified people were positive overall.

Employers (384 of 466) agreed that people with STEM qualifications are valuable to their business, even in positions where the employee's qualification (major field of study) is not a prerequisite for that role. This was particularly true of the mining industry where 84 per cent of respondents from that sector agreed with this statement, as did 88 per cent of the Professional, Scientific and Technical Services sector.

Also, 345 of 486 employers nominated their STEM-qualified staff as among their most innovative.

Flexibility to modify work practices to accommodate innovation is also crucial for business success; 342 of 483 of employers agree that their STEM-trained staff are able to adapt to changes in the business.

Capabilities that employers value

To explore perceptions further, employers were asked to indicate the importance they place on a range of employee skills and attributes (Figure 1).

The importance placed on the skills and attributes varied by industry sector (Figure 2). For example, 86 per cent of employers in the Information, Media and Telecommunications sector rated programming important or very important – much higher than other sectors. This sector also rated design thinking as a high priority.

Respondents were asked to list any additional skills which they considered important to their workplace. Overwhelmingly, "communication" was identified as important.

Comparing STEM and non-STEM qualified employees

Employers compared their experience with STEM and non-STEM qualified employees against the desirable attributes listed (Figure 3). Those who employ both STEM and non-STEM qualified employees (410 employers) rated STEM-qualified employees higher, on average, across the majority of attributes, including the four most highly ranked. STEM qualified employees were particularly highly rated relative to non-STEM in the Financial and Insurance Services, Construction and Health Care and Social Assistance industry sectors.

Figure 1: Importance of skills and attributes in the workplace

Respondents' rating of each of 13 different skills and attributes. Employers were asked to rate each skill's importance on the following Likert scale: Not important; A little important; Moderately important; Important; or Very important. The coloured bars represent the distribution of respondents between the response categories.

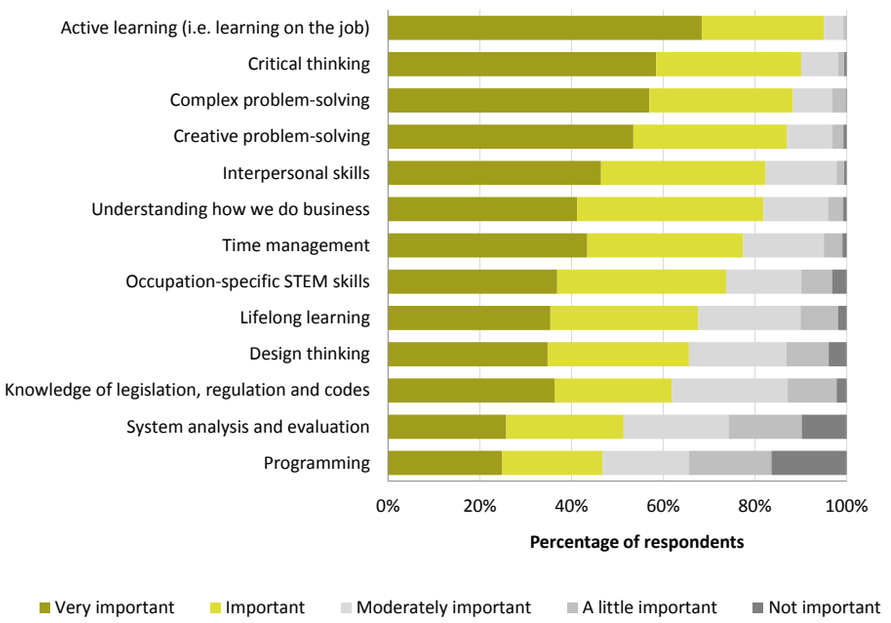

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Figure 2: To what extent are the following skills and attributes important to your workplace?

Percentage of employers in each industry sector by skill level that answered 'important' or 'very important'. Cells below the 50th percentile of values in the table are coloured red and those above blue.

	Agriculture, Forestry & Fishing	Construction	Education & Training	Electricity, Gas, Water & Waste Services	Financial & Insurance Services	Health Care & Social Assistance	Information Media & Telecomms.	Manufacturing	Mining	Professional, Scientific & Technical Services	Public Admin. & Safety
Active learning (i.e. learning on the job)	96	100	83	100	98	82	96	93	94	97	94
Complex problem-solving	75	67	78	86	95	82	91	85	97	97	88
Creative problem-solving	88	89	89	100	83	64	91	87	88	97	76
Critical thinking	75	56	94	100	95	91	91	86	97	92	94
Design thinking	42	75	78	57	47	40	100	83	78	73	47
Interpersonal skills	79	78	94	86	75	91	91	75	71	87	88
Knowledge of legislation, regulation and codes	67	44	61	43	80	82	50	58	59	67	65
Lifelong learning	78	33	94	71	70	64	70	57	70	76	59
Occupation-specific STEM skills	77	56	59	100	78	45	78	71	71	79	76
Programming	14	25	44	57	48	30	86	44	44	41	25
System analysis and evaluation	32	29	56	71	44	60	83	55	47	52	44
Time management	75	78	76	71	70	55	87	78	67	86	71
Understanding how we do business	88	89	94	86	75	100	74	84	85	84	82

Expected demand

Employers considered their anticipated requirements for STEM-qualified people over the next five to ten years. Of 451 respondents, 241 expected an increase in demand for STEM qualified professionals, while 34 expected a decrease. Almost 40 per cent of those expecting an increase in demand were from the Manufacturing and Professional, Scientific and Technical Services industry sectors.

The same question was asked of employers regarding their expected demand for STEM qualified technicians and trades people. Of the 342 respondents, 169 expected an increase in demand, while 33 expected a decrease.

Expectations differed across industry sectors. For instance, 79 per cent of the Information Media and Telecommunications sector expected an increase in demand for professionals whilst 24 per cent of the mining industry expected a decrease.

Recruitment

The survey gathered information regarding attitudes towards PhD graduates (233 employers completed questions regarding the role of PhD graduates). The three main roles of PhD graduates were: provision of professional services (119 of 188), research and development (119 of 188) and leadership/management (113 of 118).

Where respondents did not employ PhDs, it was because the qualification was not a requirement for the role (31 of 46), they lacked practical experience (23 of 46) or they lacked required business knowledge (22 of 46).

Of the 429 employers who responded to a question regarding recruitment of early career STEM qualified people, 135 reported difficulties in recruiting STEM graduates with less than 5 years' experience.

And 144 of 356 employers found it difficult to recruit STEM-skilled technicians and trade workers.

Despite receiving applications for advertised positions, difficulty was reported in hiring, indicating a mismatch between the skills required and those possessed by the applicants. The industry sectors with the highest percentage of professional positions unfilled were Public Administration and Safety sector (24 per cent, 7 applications per position); Financial and Insurance Services (21 per cent, 13 applications per position); and Agriculture, Forestry and Fishing (16 per cent, 13 applications per position).

Employers reported on the issues they had encountered in the recruitment of these staff. Of the 280 employers that responded, 214 had encountered problems. Two issues were reported—supply and quality.

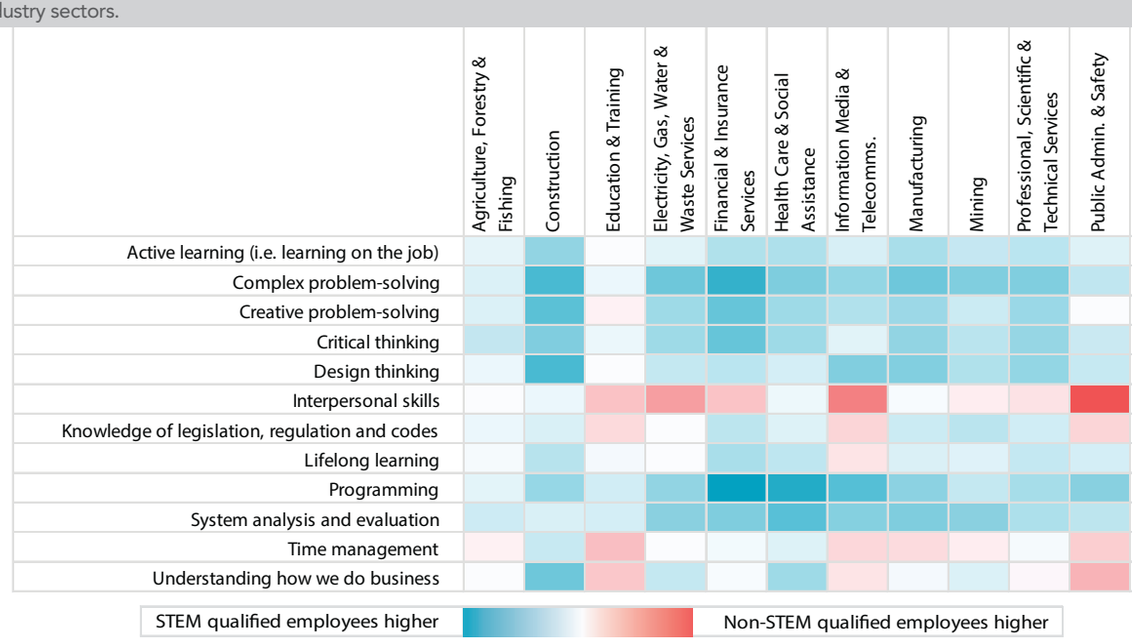
Regarding supply, a lack of applications for STEM positions had been encountered by 45 of 280 employers, and a shortage of STEM-qualified graduates was reported by 59 of 280 employers.

Regarding quality, employers reported receiving applications from candidates with unsatisfactory skills such as a lack of business understanding (101 of 280); a lack of practical experience and lab skills (92 of 280); a lack of general workplace experience (98 of 280); or from people with qualifications inappropriate for their business needs (72 of 280).

These workplace issues were of particular concern to the Professional and Scientific Services; Manufacturing; Information Media and Telecommunications; and Agriculture, Forestry and Fishing sectors.

Figure 3: Comparison of employer perceptions of the skill levels of STEM and non-STEM employees

Employers were asked to rate the skill level of STEM and non-STEM employees. The chart below compares employers' perceptions of the skill levels of STEM and non-STEM qualified employees - displaying the difference between the average score for each skill across industry sectors.



Work experience

Employers indicated the importance of a range of candidate attributes when assessing the suitability of STEM qualified applicants for their workplace. Over two thirds (224 of 323) responded that work experience in a relevant industry was important or very important. Over half (162 of 320) indicated that work experience of greater than 12 weeks was important or very important. However, in response to a specific question, only 140 of 502 employers offer structured work placements to students.

Collaboration between educational institutions and Australian workplaces

In total, 314 of 507 respondents reported some level of engagement with a post-secondary institution. Large businesses were more likely to be engaged than small and medium enterprises (SMEs).

Employers were asked to indicate their level of satisfaction with this engagement across a range of engagement types. On average, just over 50 per cent of employers were satisfied. Employers were least satisfied with engagement to develop business relevant STEM courses (64 of 153) and encouragement of employees to teach at educational institutions. However, where these were available, 92 of 143 employers were satisfied with work placements for academic credit.

Of those workplaces which did not have links with post-secondary educational institutions, 55 of 167 said that they hadn't been approached, while 46 of 167 said that they had never considered approaching post-secondary educational institutions.

CONCLUSION

This report highlights a mismatch between the skills required by employers and those of job applicants. Clearly, an effort has to be made to minimise this discrepancy. The information presented here should help to identify what needs to be done.

Further Information

The full Deloitte Access Economics report, Australia's STEM workforce: a survey of employers, is available at www.chiefscientist.gov.au

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i) ABS (2014), Perspectives on Education and Training: Australians with qualifications in science, technology, engineering and mathematics (STEM), 2010–11, Cat. no. 4250.0.55.005. Australian Bureau of Statistics, Canberra.
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*Dr Prinsley and Dr Baranyai are from the Office of the Chief Scientist

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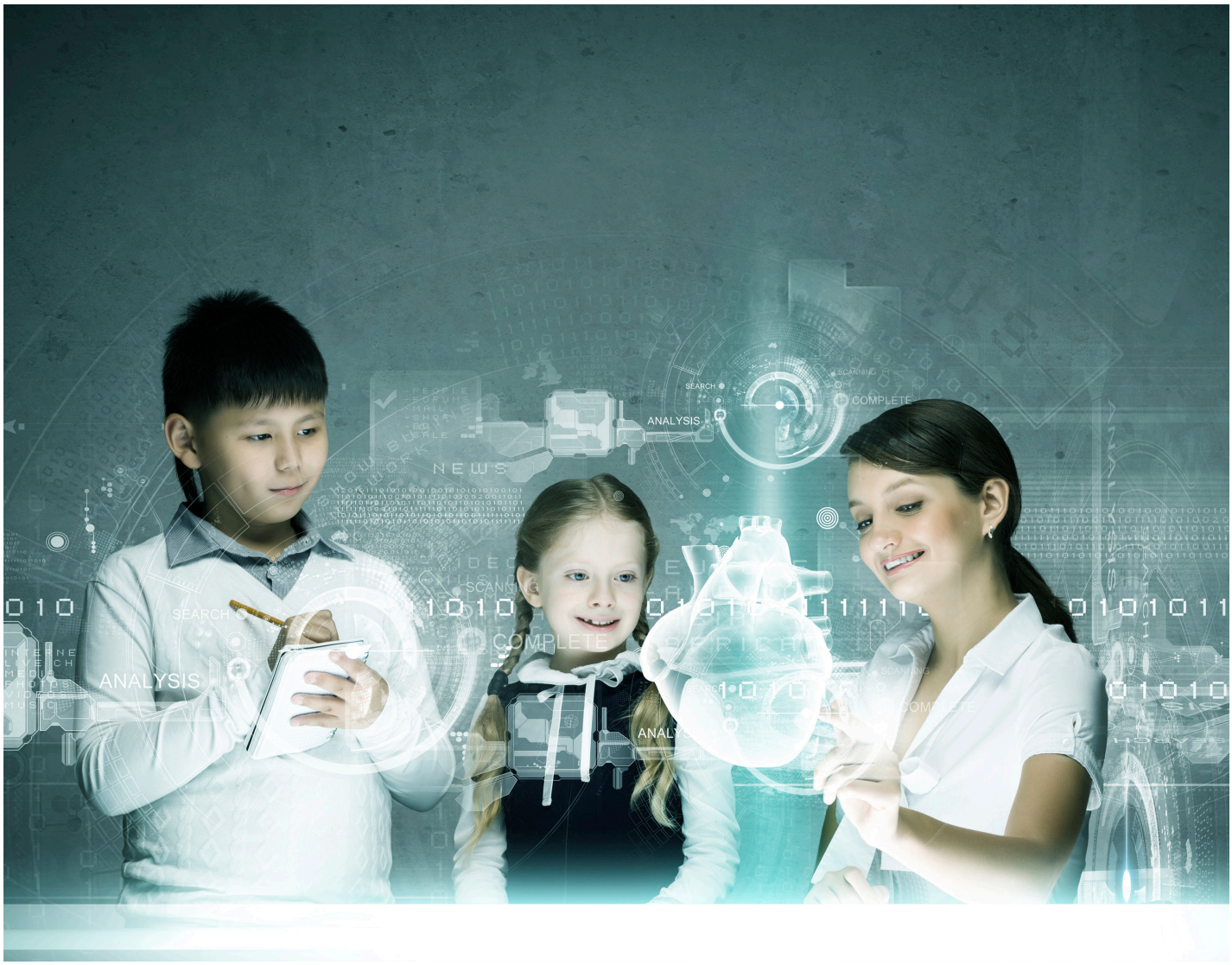
WORLD ECONOMIC FORUM

COMMITTED TO IMPROVING THE STATE OF THE WORLD

Industry Agenda

New Vision for Education
Unlocking the Potential of Technology

Prepared in collaboration with The Boston Consulting Group



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Executive summary

To thrive in a rapidly evolving, technology-mediated world, students must not only possess strong skills in areas such as language arts, mathematics and science, but they must also be adept at skills such as critical thinking, problem-solving, persistence, collaboration and curiosity. All too often, however, students in many countries are not attaining these skills. In this context, the World Economic Forum has taken on a multi-year initiative, New Vision for Education, to examine the pressing issue of skills gaps and explore ways to address these gaps through technology.

In this report, we undertook a detailed analysis of the research literature to define what we consider to be the 16 most critical "21st-century skills". Our study of nearly 100 countries reveals large gaps in selected indicators for many of these skills – between developed and developing countries, among countries in the same income group and within countries for different skill types. These gaps are clear signs that too many students are not getting the education they need to prosper in the 21st century and countries are not finding enough of the skilled workers they need to compete.

In response, numerous innovations in the education technology space are beginning to show potential in helping address skills gaps. These technologies have the potential to lower the cost and improve the quality of education. In particular, we found that education technology can complement existing and emerging pedagogical approaches such as project-based, experiential, inquiry-based and adaptive learning methods. In addition, education technology can be uniquely deployed to facilitate the teaching of 21st-century skills such as communication, creativity, persistence and collaboration.

Given the early stages of technology adoption, however, we acknowledge that its full potential to have an impact on student learning in primary and secondary education has yet to be realized. We also appreciate that education technology is only one potential component of the solution to the challenges facing education throughout the world. We have found that education technology can yield the best results if it is tailored to a country's unique educational challenges, such as those related to inadequately trained teachers or insufficient financial resources, among others.

Our survey of educational technology trends revealed that much more can be done to develop higher-order competencies and character qualities, to align technologies with learning objectives and to develop learning approaches that efficiently and comprehensively deploy technology throughout the stages of instruction and learning.

In this report, we argue that for technology to reach its greatest potential it needs to be better integrated into an instructional system we call the "closed loop". For instance, at the classroom level, education technologies should be integrated within a loop that includes instructional delivery, ongoing assessments, appropriate interventions and tracking of outcomes and learning. At the system level, which can include countries, districts and school networks, we argue that technology can be factored into the broader educational policy decisions that align standards and objectives with 21st-century skills.

We have identified an illustrative set of instructional and institutional resources and tools that further strengthen the instructional system and support the closed loop. Examples of these include personalized and adaptive content and curricula, open educational resources and digital professional development tools for teachers. We also reference three distinct school networks from different parts of the world to illustrate how technology is being deployed to address challenges unique to local country contexts.

Delivering on a technology-enabled closed-loop instructional system – one that will help close the 21st-century skills gap – will ultimately require effective collaborations among a complex and interconnected group of policy-makers, educators, education technology providers and funders. When implemented thoughtfully, these collaborations can begin to bring the most effective education technologies to more of the world's students in an effort to address 21st-century skills gaps.

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Chapter 1: The skills needed in the 21st century

To thrive in today's innovation-driven economy, workers need a different mix of skills than in the past. In addition to foundational skills like literacy and numeracy, they need competencies like collaboration, creativity and problem-solving, and character qualities like persistence, curiosity and initiative.

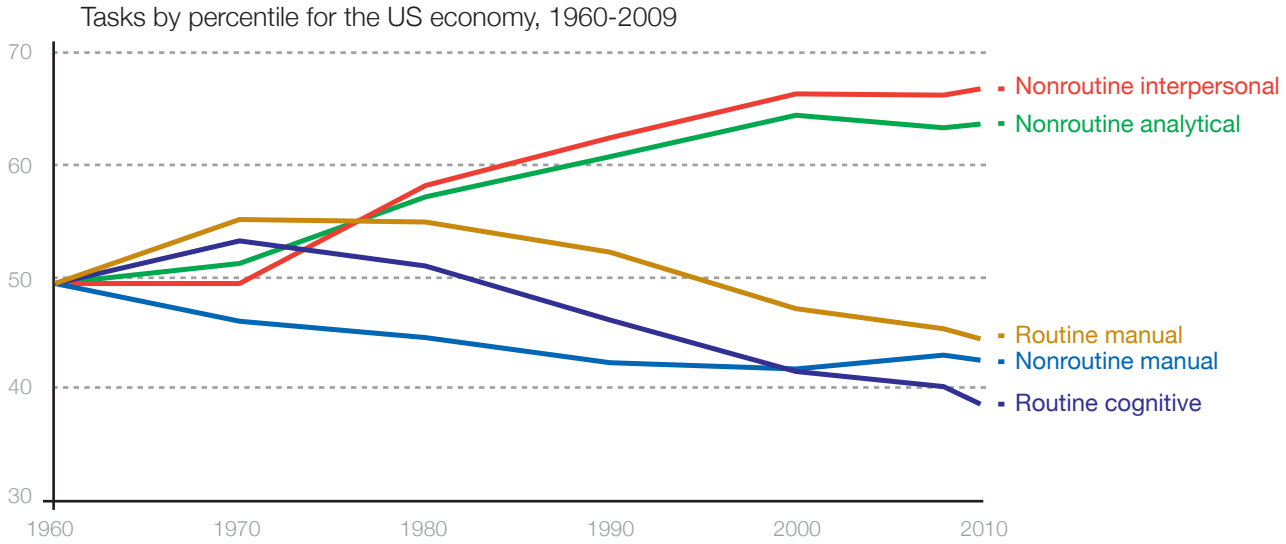
Changes in the labour market have heightened the need for all individuals, and not just a few, to have these skills. In countries around the world, economies run on creativity, innovation and collaboration. Skilled jobs are more and more centred on solving unstructured problems and effectively analysing information. In addition, technology is increasingly substituting for manual labour and being infused into most aspects of life and work. Over the past 50 years, the US economy, as just one of many developed-world examples, has witnessed a steady decline in jobs that involve routine manual and cognitive skills, while experiencing a corresponding increase in jobs that require non-routine analytical and interpersonal skills *(see Exhibit 1)*. Many forces have contributed to these trends, including the accelerating automation and digitization of routine work.

The shift in skill demand has exposed a problem in skill supply: more than a third of global companies reported difficulties filling open positions in 2014, owing to shortages of people with key skills.[1] In another example, across the 24 countries included in the Programme for the International Assessment of Adult Competencies (PIAAC), an average of 16% of adults had a low proficiency in literacy and an average of 19% had a low proficiency in numeracy.[2] Only an average of 6% of adults demonstrated the highest level of proficiency in "problem-solving in technology-rich environments."[3]

To uncover the skills that meet the needs of a 21st-century marketplace, we conducted a meta-analysis of research about 21st-century skills in primary and secondary education. We distilled the research into 16 skills in three broad categories: *foundational literacies*, *competencies* and *character qualities*[4] *(see Exhibit 2; see also Appendix 1 for definitions of each skill).*

- *Foundational literacies* represent how students apply core skills to everyday tasks. These skills serve as the base upon which students need to build more advanced and equally important competencies and character qualities. This category includes not only the globally assessed skills of *literacy* and *numeracy*, but also *scientific literacy*, *ICT literacy*,[5] *financial literacy* and *cultural and civic literacy*. Acquisition of these skills has been the traditional focus of education around the world. Historically, being able to understand written texts and quantitative relationships was sufficient for entry into the workforce. Now, these skills represent just the starting point on the path towards mastering 21st-century skills.

Exhibit 1: The labour market increasingly demands higher-order skills



Note: The starting point of the chart has been indexed to 1960.
Adapted from Levy, Frank and Richard J. Murnane. "Dancing with robots: Human skills for computerized work." Third Way NEXT. 2013. (http://content.thirdway.org/publications/714/Dancing-With-Robots.pdf) Data provided by David Autor at MIT and updated from the original 2003 study by Autor, Levy and Murnane.

[1] "The Talent Shortage Continues: How the Ever Changing Role of HR Can Bridge the Gap." Manpower Group. 2014. (http://www.manpowergroup.com/wps/wcm/connect/manpowergroup-en/home/thought-leadership/research-insights/talent+shortage/talent+shortage#.VMvTyjt0xVc)
Note: Manpower Group interviewed more than 37,000 employers in 42 countries in the first quarter of 2014 and found that on average 36% reported having difficulty filling jobs, the highest proportion in seven years.

[2] "Low proficiency" corresponds to adults performing at level 1 (the lowest proficiency level) or below.

[3] "OECD Skills Outlook 2013: First Results from the Survey of Adult Skills." Programme for the International Assessment of Adult Competencies (PIAAC). Organisation for Economic Co-operation and Development. 2013. (http://www.oecd.org/site/piaac/surveyofadultskills.htm)

[4] We referenced frameworks from European Skills, Competences, Qualifications and Occupations (ESCO), Partnership for 21st-Century Skills, enGauge, Brookings and Pearson.

[5] ICT stands for information and communications technology.

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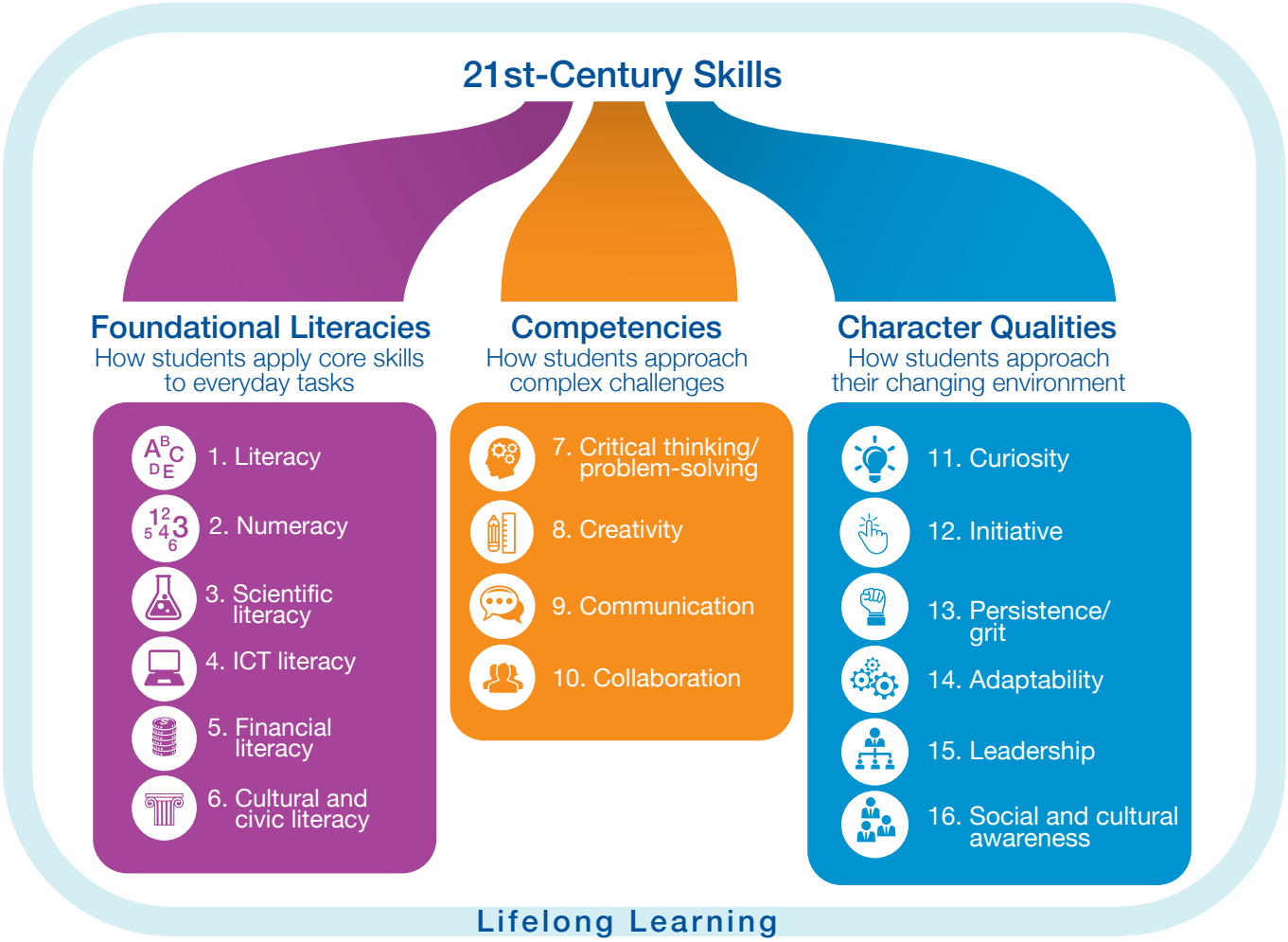
- *Competencies* describe how students approach complex challenges. For example, *critical thinking* is the ability to identify, analyse and evaluate situations, ideas and information in order to formulate responses to problems. *Creativity* is the ability to imagine and devise innovative new ways of addressing problems, answering questions or expressing meaning through the application, synthesis or repurposing of knowledge. *Communication* and *collaboration* involve working in coordination with others to convey information or tackle problems. Competencies such as these are essential to the 21st-century workforce, where being able to critically evaluate and convey knowledge, as well as work well with a team, has become the norm.
- *Character qualities* describe how students approach their changing environment. Amid rapidly changing markets, character qualities such as *persistence* and *adaptability* ensure greater resilience and success in the face of obstacles. *Curiosity* and *initiative* serve as starting points for discovering new concepts and ideas. *Leadership* and *social and cultural awareness* involve constructive interactions with others in socially, ethically and culturally appropriate ways.

While all 16 of these skills are important, we have observed little consistency in their definition and measurement. This is especially true for competencies and character qualities. The lack of comparable indicators poses a challenge for policy-makers and educators in measuring progress globally. Another problem is that most indicators focus on foundational literacies, while the development of indicators measuring competencies and character qualities still remains at an early stage. In addition, differences in scores between some competencies and character qualities, such as creativity, initiative and leadership, are likely influenced by cultural factors and as such may be difficult to compare. For seven skills within competencies and character qualities we were unable to make any comparisons due to the absence of comparable data at scale, even for the more developed countries of the Organisation for Economic Co-operation and Development (OECD). It is of crucial importance that measures for these skills be developed and tracked in the future. *(See Appendix 2 for a discussion of the challenges of measuring performance across countries, as well as Appendix 3 for the sources used in this report for each indicator.)*

Much more needs to be done to align indicators, ensure greater global coverage for key skills, establish clear baselines for performance integrated with existing local assessments, standardize the definition and measurement of higher-order skills across cultures and develop assessments directed specifically towards competencies and character qualities.

Exhibit 2: Students require 16 skills for the 21st century



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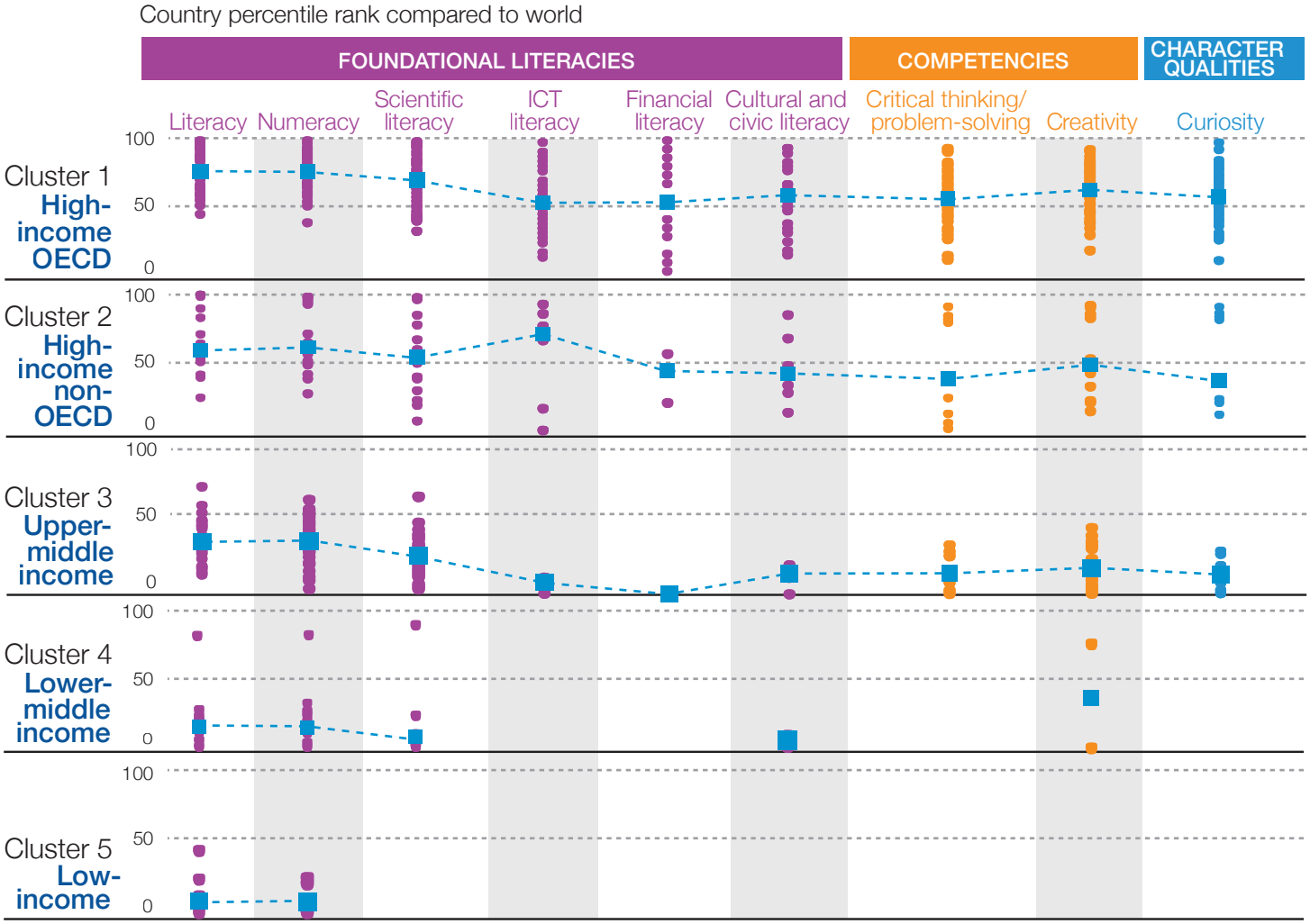
Chapter 2: The 21st-century skills gap

An in-depth analysis of performance indicators across 91 countries has found stark differences for different skill types not only across income clusters, as defined by the World Bank, but also within the same income cluster and within countries. While the differences are most pronounced between developed and developing countries, we also found wide variations in performance among high-income countries. In addition, we found differences within countries in terms of performance on foundational literacies versus higher-order competencies and character qualities.

Starting with differences between developed and developing countries, we found that higher-income countries in the OECD – which includes developed countries such as the United States, Germany, Japan and the United Kingdom – tend to perform much better on average across most skills than developing countries in the upper-middle-income group, which includes countries such as Brazil, Malaysia, South Africa and Turkey *(see Exhibit 3; Appendix 4 includes the members of each income group)*. For instance, median performance for upper-middle-income countries in our sample on the 2012 literacy test by the Programme for International Student Assessment (PISA) was 416, while high-income OECD countries scored significantly higher at 499.

While broad differences between high-income OECD countries and upper-middle-income countries can be discerned, it can be much more challenging to draw comparisons between these income clusters and lower-middle and low-income clusters. Virtually none of the lower-income countries take part in comparable tests such as PISA. A high-level analysis of regional tests, such as the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ), does allow a ranking comparison inclusive of some lower-income countries for literacy and numeracy *(see Appendix 5 for a comparison of data across three tests we used in this report)*. The analysis confirms that higher-income countries do indeed perform better. However, notable exceptions exist, such as Vietnam, which ranks on par with Germany and ahead of France on literacy, and Tanzania, which ranks ahead of Brazil, Malaysia, Indonesia and South Africa on literacy in our sample. These exceptions show that income is only one of many factors affecting educational outcomes. As such, it is important to holistically evaluate unique country contexts when devising solutions to address skills gaps.

Exhibit 3: A wide variation in skills exists within countries and among income groups



Source: World Bank income clustering for 91 sample countries. See Appendix 3 for select indicators behind each skill.
Note that for some skills there were very few data points.

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Context matters

Underlying the skills gap are significant macro-level issues that impede learning. These factors include fundamental economic and social problems, such as poverty, conflict, poor health and gender discrimination. Progress in addressing the 21st-century skills gap cannot be made without tackling these basic elements.

In addition, we identified four key country-level educational areas in which many countries outperform or underperform *(see Appendix 3 for the indicators used to measure them and the challenges in doing so)*:

1. **Policy enablers:** Standards that govern K-12 education
2. **Human capital:** Teacher quality, training and expertise
3. **Financial resources:** The importance of education in public budgets
4. **Technological infrastructure:** Access to new digital tools and content via the internet

Deficiencies in each of these areas disproportionately affect low-income countries. Exhibit 4 explores how five income groups rate on these educational factors. For example, lower-income countries rank in the bottom quartile of our sample (the median rank is in the 26th percentile) in terms of the number of students per trained teacher in primary school – a proxy measure of human capital – compared with high-income countries, which tend to have many more trained teachers (the median rank is in the 86th percentile). Similarly, wide disparities can be seen in the other indicators.

The issues also manifest themselves in different ways: some educational systems face high teacher absenteeism, while others have too many teachers who have not mastered the content they are required to teach, for example. Each country and culture therefore requires unique solutions.

Technology has a role to play in addressing some of these contextual factors. The Varkey Foundation, through its Making Ghanaian Girls Great (MGCubed) project, is an example of an organization working around the constraints of human capital with the help of technology.[6] Since 2013, the project has established a network of 72 state schools in two regions of Ghana to improve access to education through satellite-based interactive distance learning. The project provides daily English and mathematics classes and aims to reach more than 3,000 marginalized girls. The project is supported by the UK government's Department for International Development, as part of its Girls' Education Challenge.

MGCubed equips each classroom with a satellite dish and technology hardware powered by solar energy to combat the challenges of poor electricity and internet infrastructure. Through a high-speed satellite broadband connection, the project connects each classroom to a professional TV studio based in the capital city of Accra, where master teachers deliver lessons across multiple classrooms to up to 1,000 students at a time. The interactive system enables master teachers to take questions in real time from students working with their own teachers, who facilitate the learning in local classrooms.

The project helps address endemic problems with teacher quality and absenteeism, which can be as high as 35% in some regions of the country, according to the organization. Local teachers in each of the network schools also receive technology and teacher training to participate in the programme. Over time, the project aims to instill some of the teaching practices modeled by the project's master teachers in local teachers.

The MGCubed project's results will be tightly monitored – the pilot is undergoing an independent randomized control trial to evaluate its outcomes and effectiveness – providing intelligence about the extent that distance-learning projects can transform the prospects for girls who participate, as well as whether it can be replicated across Africa.

[6] The Varkey Foundation is the philanthropic arm of GEMS Education, which designed the pilot.

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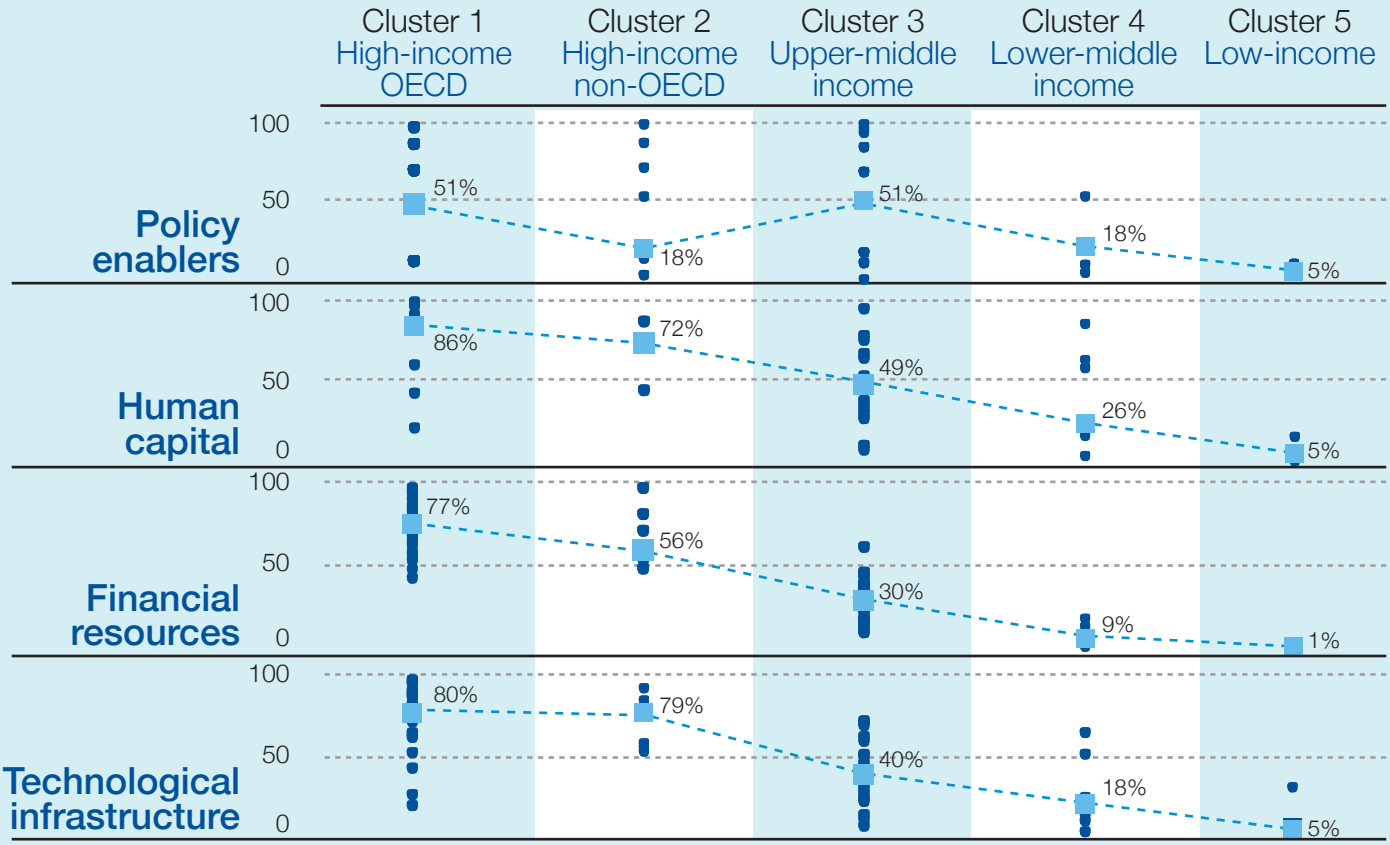
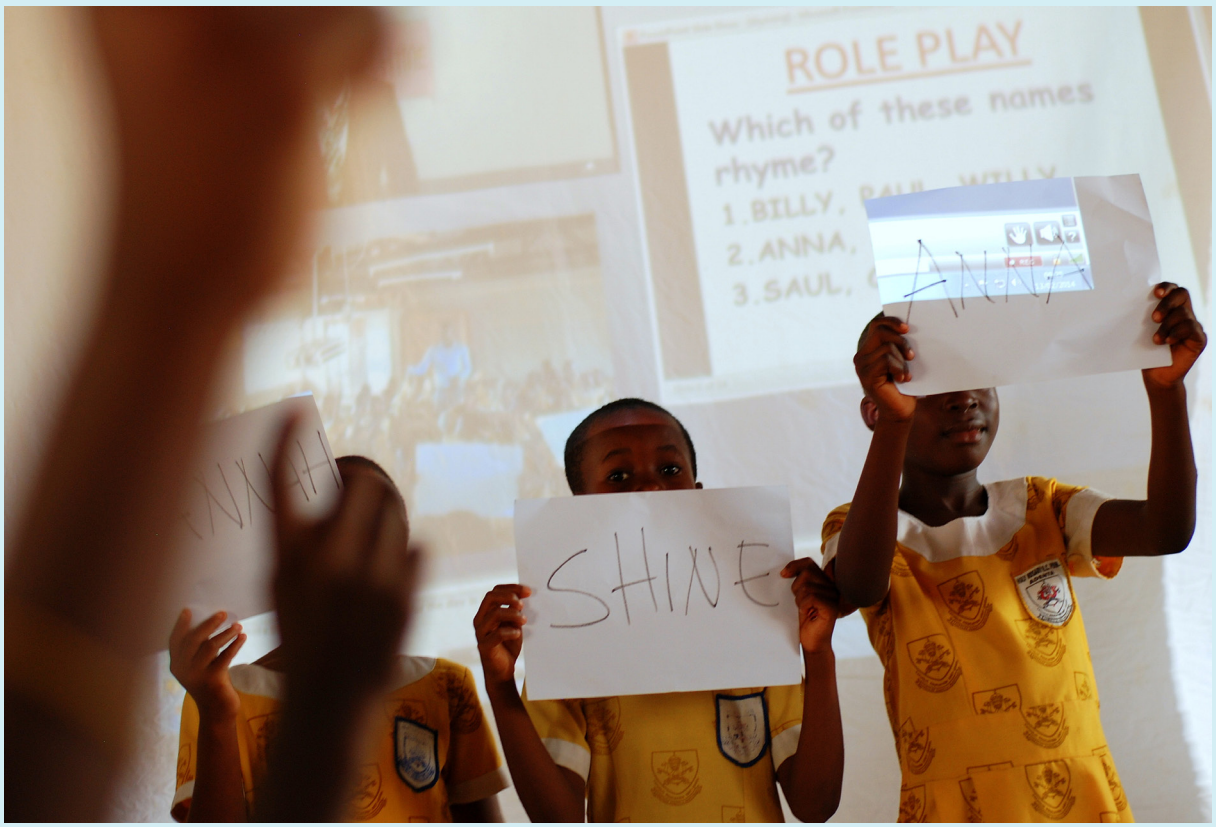
Exhibit 4: Four key factors are holding countries back

Country percentile rank compared to world



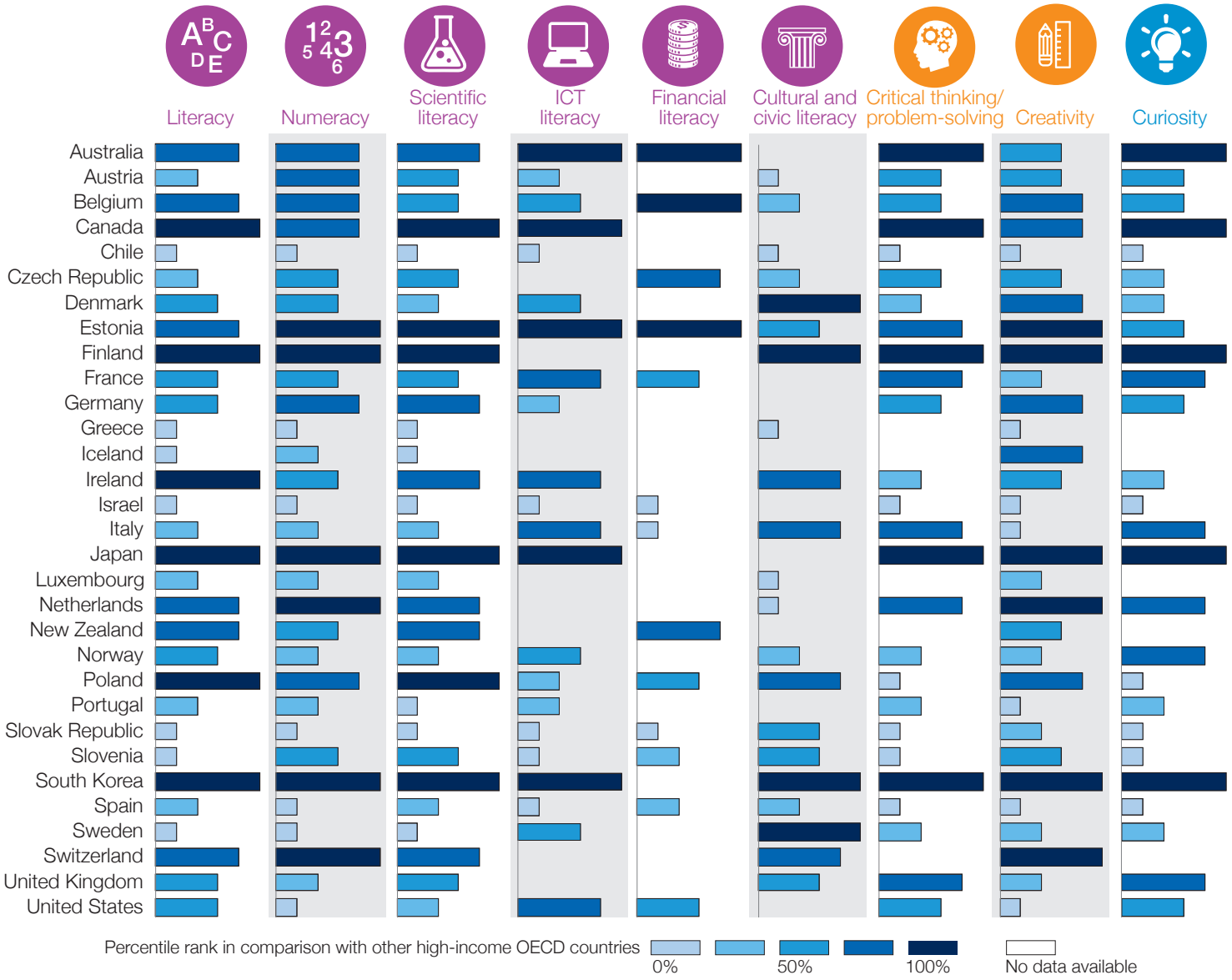
Source: World Bank income clustering for 91 sample countries. See Appendix 3 for select indicators behind each skill.
Note that for some skills there were very few data points.



Source: GEMS Education Solutions.

Exhibit 5: Skills vary widely among wealthy countries

A comparison of select skill indicators among a sample of high-income OECD countries



Source: World Bank income clusters. See Appendix 3 for the skill indicators used.

Broad differences in performance based on income make intuitive sense. More surprising are the wide variations in skills performance within even high-income clusters. Exhibit 5 shows skills gaps when high-income OECD countries are compared to each other.

As one high-profile example, the United States performs relatively well on most skills when compared with the entire world. But when compared with high-performing peers such as Japan, Finland or South Korea, the United States shows significant gaps in numeracy and scientific literacy. The United States ranked 36th out of 65 countries that took the 2012 PISA mathematics test (with a score of 481) and 28th out of 65 countries on the 2012 PISA science test (with a score of 497), for instance, compared with Japan's 2012 ranking of 7th in mathematics (a 536 score) and 4th in science (a 547 score).

In addition to gaps found vertically between countries, horizontal gaps also exist within the same country. At an individual country level, a gap exists between foundational literacies and competencies and character qualities such as critical thinking, creativity and curiosity. For example, Poland performs well on a range of indicators representing foundational literacies, even while displaying gaps in critical thinking/problem-solving and curiosity. Similarly, Ireland stands out in terms of foundational skill indicators relative to other OECD countries, but shows gaps when compared to peers on critical thinking/problem-solving, creativity and curiosity.

Some income clusters display strong performance across all skills. For example, Canada, Finland, South Korea and Japan are among the top performers within the high-income OECD group on all skills.

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Chapter 3: The potential of technology to help close the skills gap

Numerous innovations in the education technology space are beginning to show potential in improving education and helping address skills gaps. To help lower the cost and improve the quality of education, education technology is being used to:

- Find creative solutions to fundamental challenges in many countries, such as a lack of well-trained teachers and broadly accessible technology infrastructure
- Make education available to a broader audience at a much lower cost or provide higher quality instruction at the same price
- Enable easier scaling up of promising models within local markets and the transfer of best practices across markets in ways that can be sustained over the long term
- Gain insight into how and what students learn in real time by taking advantage of the greater variety, volume and velocity of data
- Increase teacher productivity, freeing up valuable time from tasks such as grading and testing, which can be used for differentiated teaching of competencies and character qualities

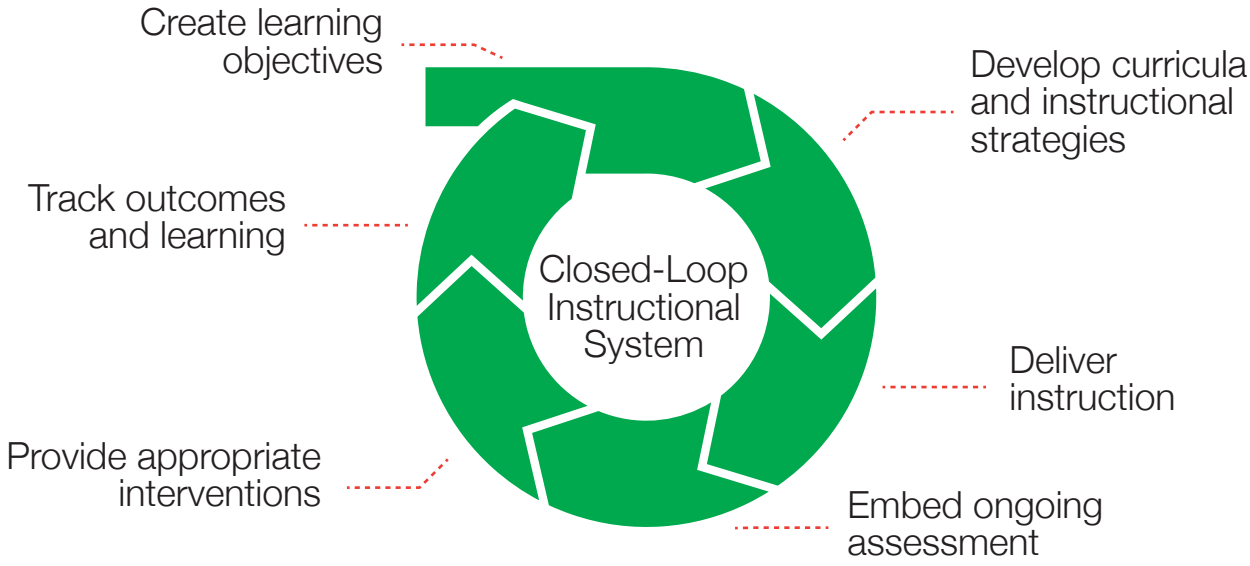
In addition, education technology can be deployed to develop 21st-century skills such as communication, creativity, persistence and collaboration, as is explored in the representative examples below.

Of course, technology is only one element in a portfolio of vital solutions that aim to close the 21st-century skills gap. These include strategies such as better teacher preparation, new modes of learning and wraparound services for struggling families.

But when educators add education technology to the mix of potential solutions, we find they are most effective if applied within an integrated instructional system known as the closed loop. As in engineering or manufacturing, the closed loop refers to a system that requires an integrated and connected set of steps to produce results. In the educational world, the closed-loop instructional system works similarly. At the classroom level of the closed loop, educators create learning objectives, develop curricula and instructional strategies, deliver instruction, embed ongoing assessments, provide appropriate interventions based on student needs and track outcomes and learning. All these efforts must be linked together as well as aligned with the goal of developing 21st-century skills *(see Exhibit 6)*.

To understand how technology can enhance learning as one tool in a portfolio, we surveyed the education technology landscape for trends and promising approaches to developing 21st-century skills. Based on our research and interviews with dozens of players in the education field, we homed in on a number of resources, as well as school networks that place a heavy emphasis on technology, as representative examples of those trends. In this section, we focus exclusively on skill development in primary and secondary education. By the time students enter college and the labour market, deficiencies that have not been addressed

Exhibit 6: An instructional system known as the closed loop is necessary to address skills gaps



earlier can be far more difficult and costly to remedy.

Through our analysis, we categorized the technologies that further strengthen the closed loop to address 21st-century skills gaps and deliver outcomes. The first category includes instructional resources that help address 21st-century skills gaps through the design, delivery and assessment of learning. These include personalized and adaptive content and curricula, open educational resources, communication and collaboration tools and interactive simulations and games. The second category includes institutional resources that help the closed loop deliver outcomes by improving human capital development and strengthening management systems. These include digital professional development resources for teachers and student information and learning management systems. At the end of this chapter, we also explore three school networks attempting to use education technology within the closed loop as they respond to the respective challenges found in different parts of the world.

When education technologies are layered throughout the closed loop, we argue that technology-based solutions such as the sample profiled here have the potential to enable teachers, schools, school networks and countries to scale up solutions in ways not possible before and potentially to deliver better outcomes and learning. That said, their inclusion in this report is not intended to serve as an endorsement: much more research must be done to identify the most effective uses of technology in the classroom and the most transferable solutions. In fact, most education technologies we surveyed come from the developed world and would require significant adaptations to respond to the unique challenges of and be successfully transferred to developing countries.

Instructional resources that enable the closed loop to address 21st-century skills gaps

Increasingly, best-in-class curricula aim to teach multiple skills at the same time. For example, teachers might use word problems to teach multiplication, directing students to think critically and solve problems while developing both literacy and numeracy skills. Education technology has the potential to become an option for teachers in delivering this combination of foundational literacies, competencies and character qualities.

At present, however, our research has found that most instructional activity in the education technology space has concentrated on the development of foundational literacies, given the focus of most educational standards around the world. While there has been some effort to develop competencies and character qualities, these skills are still not the primary focus of most educators and education technology developers *(see Exhibit 7)*. We conclude that to develop the full range of 21st-century skills, more resources need to be focused on competency and character quality development and aligned to particular skills. This, in turn, would help educators better evaluate products that best address their needs and contexts.

We further place the existing instructional resources into a few main categories. Those include: personalized and adaptive content and curricula, open educational resources, communication and collaboration tools and interactive simulations and games.

Personalized and adaptive content and curricula

Personalized and adaptive education technologies have mostly focused on developing foundational literacies. Product developers are attempting to deliver differentiated learning with one-on-one computer-based learning tailored to individual student needs, often used effectively with blended-learning approaches mixing in-person and online instruction. These programs can be used in conjunction with in-classroom instruction, freeing up teachers' time to deepen students' understanding of the material and to develop skills like problem-solving, creativity and collaboration. They can also harness the power of data to dynamically assess learning, address gaps and track outcomes.

Some longstanding programs, such as *Read 180*, first assess students' abilities, before later providing differentiated content based on a student's level. Others are more real-time and adaptive. The *Dreambox* mathematics application continuously analyses student actions to deliver millions of personalized learning paths tailored to each student's unique needs. Within one minute of work, the program can collect, analyse and respond to more than 800 pieces of data about a student and how he or she learns, according to the organization.

In addition to direct-to-student content, developers are also creating adaptive platforms. These can provide the back-end analytics necessary to offer an adaptive experience to students. For example, *Knewton* adaptively powers products from education companies ranging from start-ups to the largest publishers. Knewton provides an engine that allows others to build adaptive learning applications and experiences from a wide range of content, as well as to assess what works best. In addition, some companies are helping teachers create adaptive

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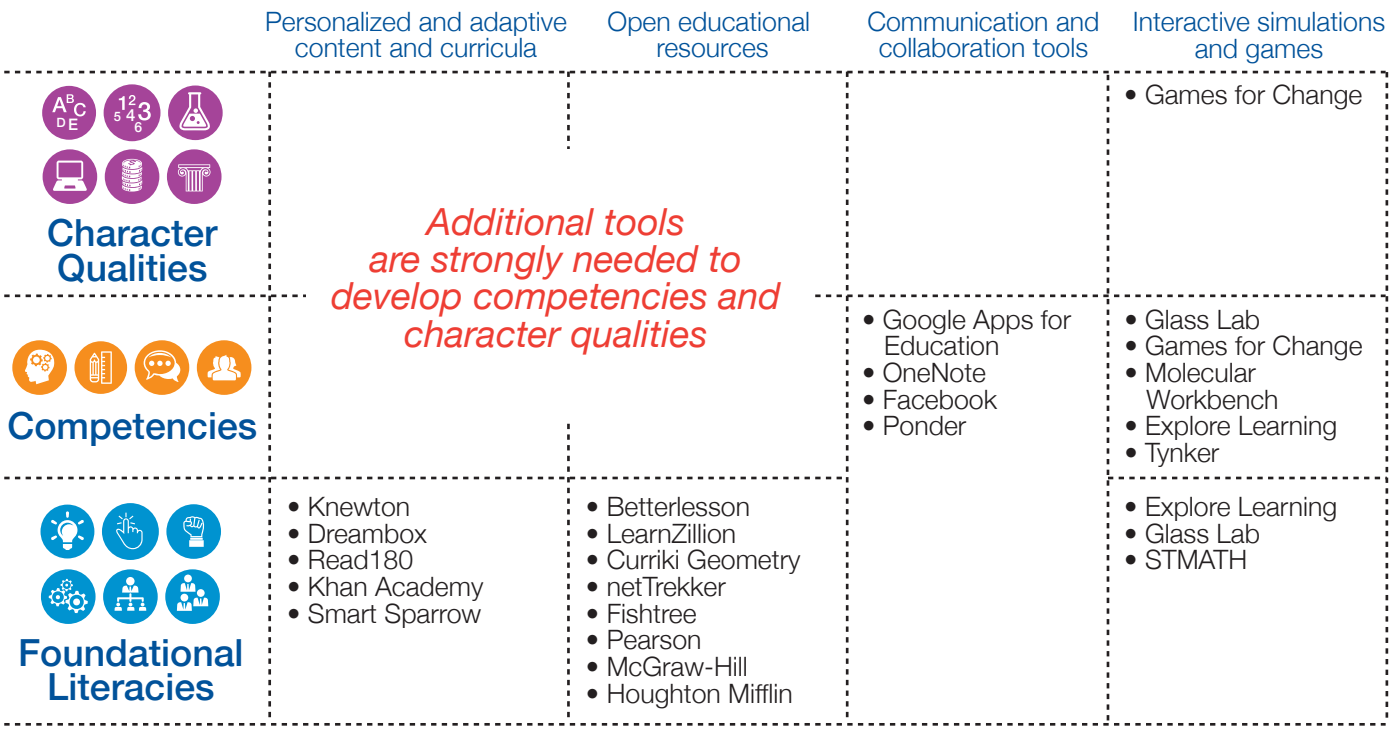
Exhibit 7: Most educational technologies are focused on developing foundational literacies



Note: Illustrative sample of resources and tools featured.

learning experiences for students: *Smart Sparrow* provides a platform for teachers to create "adaptive pathways" for the lesson materials they create. This allows teachers to design a unique and differentiated experience for students.

For adaptive learning platforms to work well, subject matter is often broken down into discrete topics that enable a logical progression from one concept to another. Part of the reason we see adaptive learning focused primarily on literacy and numeracy is that these skills have already been broken down into chunks of concepts and their connections, which a computer can use to pinpoint how knowledge builds. Standardized reading levels have been developed, as well as "knowledge maps" for mathematics concepts, such as those used by personalized learning resource *Khan Academy*. As a result, we see personalized and adaptive technologies currently most used to strengthen the closed loop in developing foundational literacies.

To reach their full potential and further develop competencies and character qualities, these technologies need to take fuller advantage of the vast amount of data that is collected as students learn. They can use the data to better understand not just what students know, but also how they interact with content and learn best.

Open educational resources

Open educational resources (OER) increase the variety, accessibility and availability of content and curricula. Similar to personalized and adaptive tools, the focus of OER is primarily on foundational literacies. Digital platforms such as *LearnZillion*, *Curriki* and *BetterLesson* are free repositories of vast amounts of open-source content, which is often user-generated. These platforms allow teachers and schools to upload, share, edit and rate content online, creating a bank of both content (subject-knowledge materials) and curricula (such as lesson plans and pedagogical materials) created and vetted by teachers. For example, LearnZillion features more than 4,000 free open-source videos, Curriki offers more than 50,000 resources, ranging from individual lessons to complete courses and BetterLesson includes more than 10,000 Common Core-aligned lessons.

Well-established publishers such as *Pearson*, *McGraw-Hill* and *Houghton Mifflin* are also incorporating OER into their proprietary materials and platforms to allow teachers to customize their lessons. Other players such as *Fishtree* are designing similar content-creation platforms through which educators can customize their lesson plans, drawing from a wide range of resources.

Given the vast amount of free and open-source content available on the internet and the limited degree of quality control, there is a pressing need to differentiate content by quality, relevance and standards alignment. Without such quality control, it is challenging for teachers to identify and incorporate high-quality content into their teaching. However, some select examples are beginning to provide aggregated and curated digital content. Through crowdsourcing and expert reviews, *Curriki Geometry*

aggregates quality content and teaching materials from its platform into a comprehensive project-based geometry solution available for free. *netTrekker* contains a subscription-based repository of expert-reviewed, standards-aligned and carefully tagged content that makes it easier for teachers to find the resources they need.

Communication and collaboration tools

A number of tools are helping students develop competencies such as collaboration and communication by facilitating group work, peer-to-peer learning and peer feedback. These tools can be further enhanced by project-based and experiential-learning pedagogical approaches that help students work together to solve problems in real time.

Students can collaborate in real time on assignments using digital tools such as *Google Apps for Education* to collectively develop documents, spreadsheets and presentations. Online communication tools also allow students to help each other. Students can now create and share digital notebooks through tools such as *OneNote*; discuss readings and assignments, share related information and keep up with classroom announcements through social networking sites such as *Facebook*; and comment on and discuss assigned readings through such sites as *Ponder*.

Interactive simulations and games

Games and simulations allow students to go beyond the traditional lecture and to interact with instructional content in an engaging way that has been called “gameful learning”. Most of the activity in this corner of the education technology space is happening within numeracy and scientific literacy. Even so, games allow a focus on multiple skills at once: while students work to improve their understanding of core concepts, they can also develop skills such as creativity, curiosity and persistence in the process. These tools, along with

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new pedagogical approaches such as project-based learning, are therefore at the forefront of addressing skills gaps in competencies and character qualities.

Game-based programmes such as *STMath* use non-numerical visualizations to develop students' intuitive understanding of mathematical concepts before attaching the symbols of traditional mathematics instruction. Instructional simulations, such as those from *ExploreLearning* and *MolecularWorkbench*, allow students to interact with abstract scientific concepts in ways that would be costly or impossible to replicate in the classroom.

Some developers are providing students with opportunities for indirect competency development through challenging experiences that require more advanced reasoning from students. For example, *GlassLab* has adapted the popular *SimCity* computer game to education, with robust assessments from ETS and Pearson and grant funding from the Gates and MacArthur foundations. *SimCityEDU: Pollution Challenge!* has four missions, each with distinct focuses on developing standards-aligned skills such as systems and critical thinking and cause and effect.

Competencies are also being indirectly developed though platforms such as *Tynker*. The site's interactive online learning games are used by more than 10,000 primary and secondary schools to teach basic computer programming skills and show potential to foster not just technological literacy but also competencies such as problem-solving, creativity, collaboration and persistence.

Few tech-based tools have been created that focus exclusively on character qualities development. This highlights the lack of attention that traditional education has given to these skills, as well as the opportunity available to product developers. An interesting exception is *Games for Change*, an organization that curates and incubates games focusing on social issues. Games have been developed that build social and cultural awareness in a variety of topics, including economics, the environment, civics and conflict. For example, *Mission US: A Cheyenne Odyssey* tells the story of westward expansion in the United States through the eyes of Native Americans.

Institutional resources that enable the closed loop to deliver outcomes

Two important sets of resources work to strengthen the closed loop at the institutional level, be it the school, network or district. Those improvements develop a key resource – teachers – as well as create better systems and data flows.

By broadly strengthening human capital and technology infrastructure – two critical elements often challenged in many educational systems – each set of resources allows for greater productivity, efficiency and effectiveness at all levels of the closed loop.

While we highlight a number of innovative examples, we observe that most digital professional development resources for teachers disproportionally focus on helping them improve foundational literacies in their students, without adequate attention to developing competencies and character qualities. To help address skills gaps, teacher training should be better aligned to 21st-century skills. In addition, administrators need to improve the use of data in learning and decision-making at both the school and system levels.

Digital professional development resources for teachers

For countries to succeed at generating 21st-century skills, they also need to help teachers more efficiently and productively develop their own skills.

Emerging online resources in professional development for teachers can have a positive impact, adding more instructional strategies to a teacher's repertoire, as well as improving their ability to execute on these strategies in the classroom. Instead of attending a district-mandated workshop with a group of other teachers at a specific date and time, now teachers can also access materials that are targeted to their particular needs anytime and anywhere.

Platforms such as *TeachScape* and *KDS* are personalizing development by providing relevant digital courses to teachers. TeachScape features more than 160 digital courses and more than 2,500 high-quality videos of teaching practice, for example. Thanks to digital resources such as these, it is easier than ever before for teachers to get the help they need to improve their instructional skills.

Technology is also fostering collaboration and coaching among teachers through tools such as video feedback and remote coaching. *Edthena*, for example, allows teachers to upload their video-recorded lectures so that other teachers and mentors on the platform can give direct feedback about the strengths and weaknesses of their teaching. Another platform, *Edconnective*, allows teachers to connect remotely with experienced teachers who can coach them during one-on-one digital sessions targeted to their specific needs.

Across the teacher professional development space, another nascent trend involves developing digital courses specifically targeting competencies and character qualities. For example, *KDS* has a course, "21st-Century Skills", in which teachers learn about new educational methods to teach

higher-order skills. Traditional hardware-oriented technology players have also moved into the professional development space. In addition to providing face-to-face learning, they have developed blended-education approaches featuring online courses, materials and teacher communities such as *Intel Teach* and *Microsoft Partners in Learning* that governments, school leaders and teachers are using to develop 21st-century skills.

Student information and learning management systems

Technology is allowing student data to be generated from an increasing number of sources, ranging from more traditional student information systems (SISs), which collect enrollment, course history and achievement data, to classroom lessons, activities and digital instructional content platforms, which are frequently channelled through learning management systems (LMSs). In addition to collecting data, LMSs have tremendous potential to indirectly facilitate the development of 21st-century skills such as collaboration and communication as students interact with digital content and with each other.

Student information and learning management systems often operate in a vacuum, however, with too little sharing and interpretation of data to help educators and administrators make informed, data-driven decisions. One US Department of Education study found that only half of teachers could accurately interpret data from their systems, for example.[7]

Greater interoperability between LMSs and SISs would allow educators to have a more comprehensive view of student learning and performance. As systems such as these become more integrated and better able to continuously track data at a detailed level over time, they can offer educators and policy-makers a better understanding of student achievement in the context of teacher performance, course design and other areas.

Major players are starting to develop more integrated solutions, such as Pearson's *Schoolnet for PowerSchool*, which combines assessment and reporting data into its widely used web-based SIS. Some charter schools are building interoperable systems as well, including *Summit Public School's* partnership with *Illuminate* to combine an SIS with assessment and reporting data. Other examples, such as *Edmodo*, *Schoology* and *Canvas*, include customizable LMS platforms that aggregate a variety of content resources.

[7] Rankin, Jenny. "When Data Systems Actively Support Data Analysis." EdSurge. June 28, 2014. (https://www.edsurge.com/n/2014-06-28-when-data-systems-actively-support-data-analysis/)

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Building the closed loop on the ground

A great deal of activity is happening within school systems to use technology to address unique challenges at the local level. A few networks of schools demonstrate how technology can be used to develop 21st-century skills – where technology is needed most and where it focuses on different levels of the closed loop. The best examples of this work often reinforce pedagogical approaches such as experiential, project-based, inquiry-based and adaptive learning, which are critical to the teaching of 21st-century skills.

Three school networks illustrate the use of technology in different country contexts – *Bridge International Academies* in Kenya (a low-income country), *Innova Schools* in Peru (an upper-middle income country) and *Summit Public Schools* in the United States (a high-income OECD country). Each example exists along a continuum of technology deployment, ranging from more focused to more holistic. And each one prioritizes technology across the closed loop according to the respective challenges faced within a country. For instance, policy-makers might prioritize the use of education technology to provide country-specific solutions, such as by addressing a lack of technology infrastructure, while educators might use education technology to prioritize changes at the classroom and network level, such as by addressing teacher absenteeism. At the same time, these best practices have the potential to be transferred to environments that face similar challenges, including poor infrastructure, weak human capital development or low college-completion rates.

By highlighting these diverse school networks, our goal is not to evaluate their approaches, outcomes or impact. Our intention is simply to present the variety of ways technology solutions are being implemented given local challenges holding back the development of 21st-century skills. The school networks featured represent emerging examples of technology's potential to find creative solutions to unique challenges at the local level, although these organizations' insights have yet to work their way into the mainstream or reach notable scale. Nonetheless, these projects hint at the direction in which the education technology space may be moving and could offer powerful lessons to educators, policy-makers and the business community alike.

Bridge International Academies

Kenya faces a number of serious educational challenges related to human capital. For example, 42% of all instructional time is lost due to teacher absenteeism from the classroom.[8] In addition, only 35% of Kenya's public school teachers display mastery in the subjects they teach.[9] As a reflection of these and other challenges, Kenyan students struggle to acquire even the most fundamental skills of literacy and numeracy: Kenya ranks in the 21st percentile for literacy and numeracy out of the 91 countries we studied.

Working within this resource-constrained context is *Bridge International Academies*, a private-school network of 405 schools spread across nearly every county in Kenya, with more than 120,000 children currently enrolled in its iconic lime-green-roofed academies. *Bridge* is using education technology in a highly focused way, primarily on one high-priority element of the closed loop – instructional delivery – to address foundational skills *(see Exhibit 8)*. Given its context working in a low-income country significantly lacking in resources and infrastructure, *Bridge* uses a relatively low-tech approach, focusing the use of education technology on teachers, a critical educational resource. Its model, which separates content development from instructional delivery, is proving transferable to other similar low-resource environments facing human capital constraints.

Bridge employs master teachers to develop curricula centrally, in the form of scripted lesson plans for 40-minute lessons that are used in every classroom across the network. Individual teachers receive these scripted lessons electronically via a tablet, along with more than 300 hours of initial induction training and in-service professional development from coaches who visit schools every three weeks. Teachers hold the tablet while delivering the content, following detailed instructions specifying everything from instructional content to classroom activities. Through its scripted instructional delivery approach, *Bridge* provides a standardized learning experience across its network, helping to control for the high variability in teacher quality across the country. In addition, its approach of separating content development from delivery allows teachers to focus on teaching children instead of creating their own lesson plans, a task that can be particularly challenging when teachers haven't mastered the curricula they teach. (Students learn with the help of traditional textbooks, workbooks, slates and other inexpensive tools.)

Technology also helps *Bridge* track teacher absenteeism rates and performance using its tablets, increasing teacher accountability – a key challenge in Kenya. To receive the centrally created curricula and lesson plans for the day, *Bridge* teachers must log on to their tablet when the day begins. This allows *Bridge* to see when teachers have arrived. Absences trigger automatic communications and follow-up actions, including calling in substitute teachers to cover classes. Through this tracking and reminder system, *Bridge* has been able to achieve teacher absenteeism rates of less than 0.5% in its schools, according to the organization. Teachers also connect their tablets to *Bridge's* servers at the end of the day, sending data that includes teacher and student attendance, assessment scores, the start and ending time of every lesson and pages taught during lessons.

In a more limited way, *Bridge* also uses education technology in the closed loop to assess students, provide timely interventions and track student outcomes. Teachers manually input student performance data into *Bridge's* tablet-based digital tracking system. Through this system, *Bridge* is able to follow up with interventions targeted to underperforming schools, as well as to modify curricula based on the most effective strategies for improving student outcomes. Student assessment data is also used to facilitate small-group and one-on-one tutoring.

As a result of its efforts to standardize teaching and learning, *Bridge* estimates that its students have gained almost an extra year of reading and mathematics instruction compared with neighbouring public schools.[10] In the process, *Bridge* offers an education at a relatively low price compared to similar schools. Attending a *Bridge* school costs an average of $7 per month, affordable enough for most of its low-income families, who earn an average of $136 per month, according to the organization.

In addition to adopting education technology in teaching and learning, *Bridge* also uses centralized technology platforms and systems that enable it to rapidly scale up its school model. The organization deploys standardized curricula, real estate, legal, human resources, production, marketing and other approaches across its network from the central office. For example, its research department pinpoints the best locations for a new academy to be built based on the needs and incomes of local families, using mobile surveys, GPS data from on-the-ground surveyors and satellite imagery.

Bridge's focus on centralized systems, research and data collection and continuous feedback has allowed the network to launch a new school approximately every three days. The organization has set itself an ambitious goal of educating 10 million low-income students in a dozen countries within 10 years.

[8] Martin, Gayle H. and Obert Pimhidzai. "Education and Health Services in Kenya: Data for Results and Accountability." Service Delivery Indicators Initiative. World Bank, African Economic Research Consortium and African Development Bank. 2013. (http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2013/07/25/000442464_20130725101359/Rendered/PDF/794420REVISED00untryReport0wAuthors.pdf)

[9] Ibid.

[10] "The Bridge Effect: Comparison of Bridge Pupils to Peers at Nearby Schools EGRA-EGMA Evaluation Programme." Bridge International Academies. Fall 2013 results, with a July 2011 baseline. (http://www.bridgeinternationalacademies.com/wp-content/uploads/2013/01/Bridge-International-Academies_White-Paper_The-Bridge-Effect_Nov-2014_Website.pdf)

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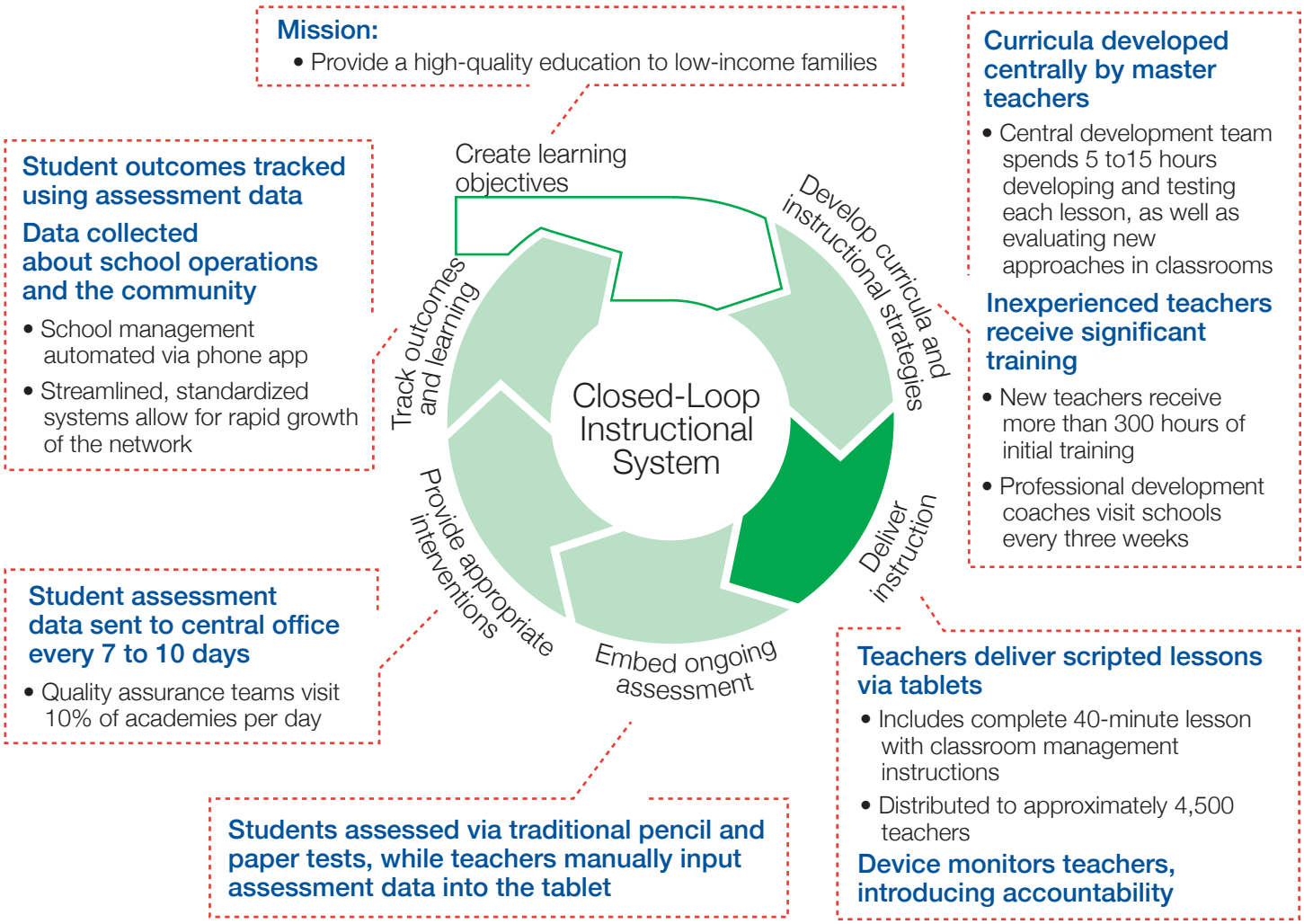
Exhibit 8: How *Bridge International Academies* uses education technology across the closed loop



Innova Schools

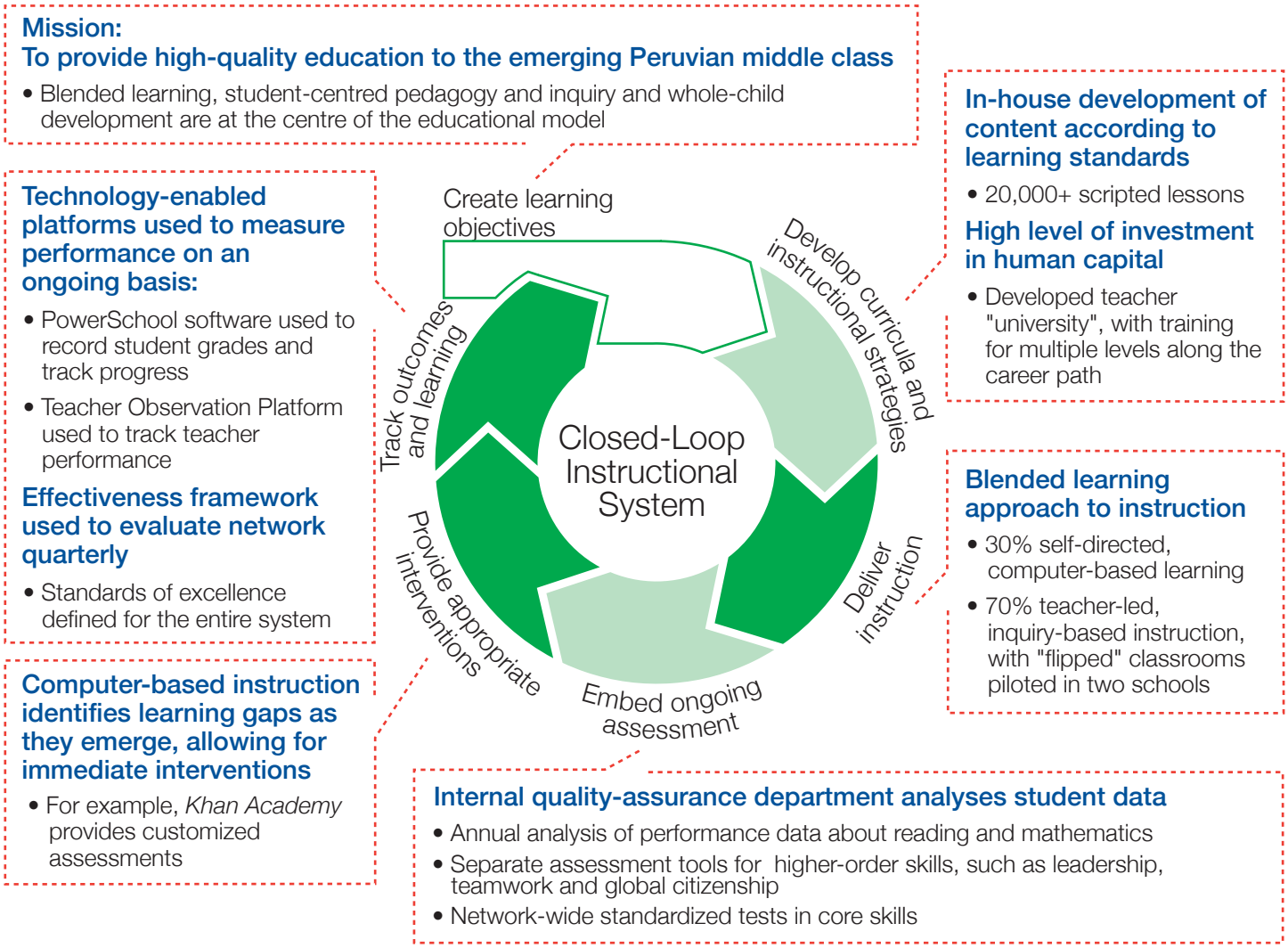
Peru also faces significant human capital challenges. Teachers have limited proficiency in even foundational literacies. According to 2007 census data, 62% of teachers did not reach an acceptable level on sixth grade reading tests and 92% did not reach an acceptable level for sixth grade mathematics.[11] These limitations in teaching ability and other factors are reflected in student performance: in 2013, only 17% of nationally assessed students were proficient in mathematics and 33% were proficient in literacy.[12]

Consider how *Innova Schools* is tackling these and other obstacles in a lower-middle-income environment. The low-cost private-school network aims to provide a world-class education to the growing Peruvian lower-middle class. It currently serves more than 13,000 students in 23 schools, with a target of 75,000 students in 70 schools by 2021. To do this, *Innova's* use of technology focuses not just on teachers, but also on students, with the greatest integration within instructional delivery, support for its inquiry-based pedagogy and assessment *(see Exhibit 9)*. Its model could be transferable to other environments facing a mix of challenges involving human capital development and other factors.

Innova uses a two-pronged, teacher-focused approach to combat the nation's human capital problems in education. Like *Bridge*, the network also develops its curriculum centrally. To date, it has created more than 20,000 scripted lessons for teachers, accessible through its Teacher Resource Center, a repository of teacher resources designed by a group of in-house specialists. *Innova* has also developed a holistic professional development strategy, investing heavily in teacher training and coaching. Teachers receive more than 100 hours of

[11] "An Alternative Reading of the IADB Study on Peru's OLPC Implementation." One Laptop Per Child. 2012. (http://www.olpcnews.com/countries/peru/an_alternative_reading_of_the_iadb_study_on_peru_olpc_implementation.html#sthash.h9KhBe44.dpuf)
[12] Census Evaluation of Students (Sistema de Consulta de Resultados de la Evaluación Censal de Estudiantes, ECE (SICRECE). Innova Schools data. 2013. (http://sistemas02.minedu.gob.pe/consulta_ece/publico/index.php)

Exhibit 9: How *Innova Schools* uses education technology across the closed loop



training per year through a corporate university and partnerships with leading institutions, as well as support through career development and mentorship programmes. Instructional coaches observe and give teachers feedback, record data from teacher observations on its online Teacher Observation Platform and identify teachers who may be struggling and need additional support. To ensure success with its innovations, *Innova* principals act as instructional leaders within the school: they make learning a priority at all school levels, use professional learning communities to build teacher capacity and rely on data analysis to track progress and direct actions.

Although professional development elements such as these are not strongly reliant on technology, they provide the foundation on which *Innova* has successfully deployed technology throughout the closed-loop system. Building on that base, *Innova* focuses on providing a deep integration of educational technology into the instructional delivery element of the closed loop. The school uses a blended learning approach in which students spend 30% of class time on computer-based learning ("solo time") and 70% on teacher-led collaborative learning sessions ("group time"). During computer-based solo time, students learn at their own pace through Khan Academy for mathematics, MyEnglishLab for English-language reading and writing, Leo for Spanish and Modus for science. Once students have acquired basic knowledge on a topic, teachers can focus group time on applying new content to different situations, working on more complex problems, thinking critically and helping students collaborate and communicate with one another.

Computer-based learning platforms also allow *Innova* to assess students in real time, provide timely interventions and track student outcomes. Each of the technology products *Innova* uses has a dashboard feature that highlights areas of difficulty for individual students. Students may use virtual

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tools outside of the school day for additional practice on concepts they may be struggling with. In addition, teachers review assessment data at the end of each quarter to identify areas for improvement and to plan for the quarter ahead.

Education technology serves to complement *Innova's* pedagogical approach of inquiry-based learning during group time. Classes start with a set of questions that challenge students, use their prior knowledge and engage them in the learning process. Once students explore the answers to those questions, teachers help them build new knowledge through short concept overviews and more challenging questions which they resolve collaboratively.

In part as a result of these elements of the closed loop, 61% of *Innova* students tested proficient in mathematics and 83% in literacy, up to three times higher than the national average. In addition, 86% of *Innova* students attend university or a technical college, according to the organization.

Innova is testing and learning from its efforts to improve these results further. It is currently piloting a "flipped classroom" instructional model that relies on digital content students can access at home to improve foundational literacies, while maximizing classroom time to collaborate with teachers and other students as they extend their skills and develop competencies and character qualities.

Summit Public Schools

While the United States ranks in the middle of OECD countries on many 21st-century skills, significant differences remain between high-income and low-income students in the country's public schools. For instance, only 30% of low-income students enroll in college, compared with 80% of high-income students.[13] And low-income students drop out of college at almost three times the rate of those with high-incomes.[14]

Summit Public Schools, a network of nine charter schools based in the San Francisco Bay Area and Washington State serving a diverse student body of nearly 2,000 students, seeks to address these challenges with a mission of preparing students for success in college, career and life. *Summit* holistically deploys education technology across the closed loop, with a focus on teachers and students and uses education technology to strengthen its project- and competency-based learning approach *(see Exhibit 10)*. Its model could be transferable to other developed-country environments with similar challenges that also feature a high degree of teacher autonomy.

Starting with learning objectives, *Summit* has developed a shared skill rubric that incorporates 36 skills targeted at college readiness, including competencies such as critical thinking. *Summit* believes that all students should be prepared with the foundational literacies, higher-order competencies and character qualities needed to be successful in college.

In terms of curricula and instruction, *Summit* students spend the majority of their time on project-based learning and teacher-led sessions. For the remainder of the day, students work through assignments at their own pace. The self-directed component enables *Summit* students to take responsibility for their own learning and to strengthen character qualities such as persistence, initiative, curiosity and adaptability, while the group component fosters further development of competencies through discussion, critical thinking and collaboration.

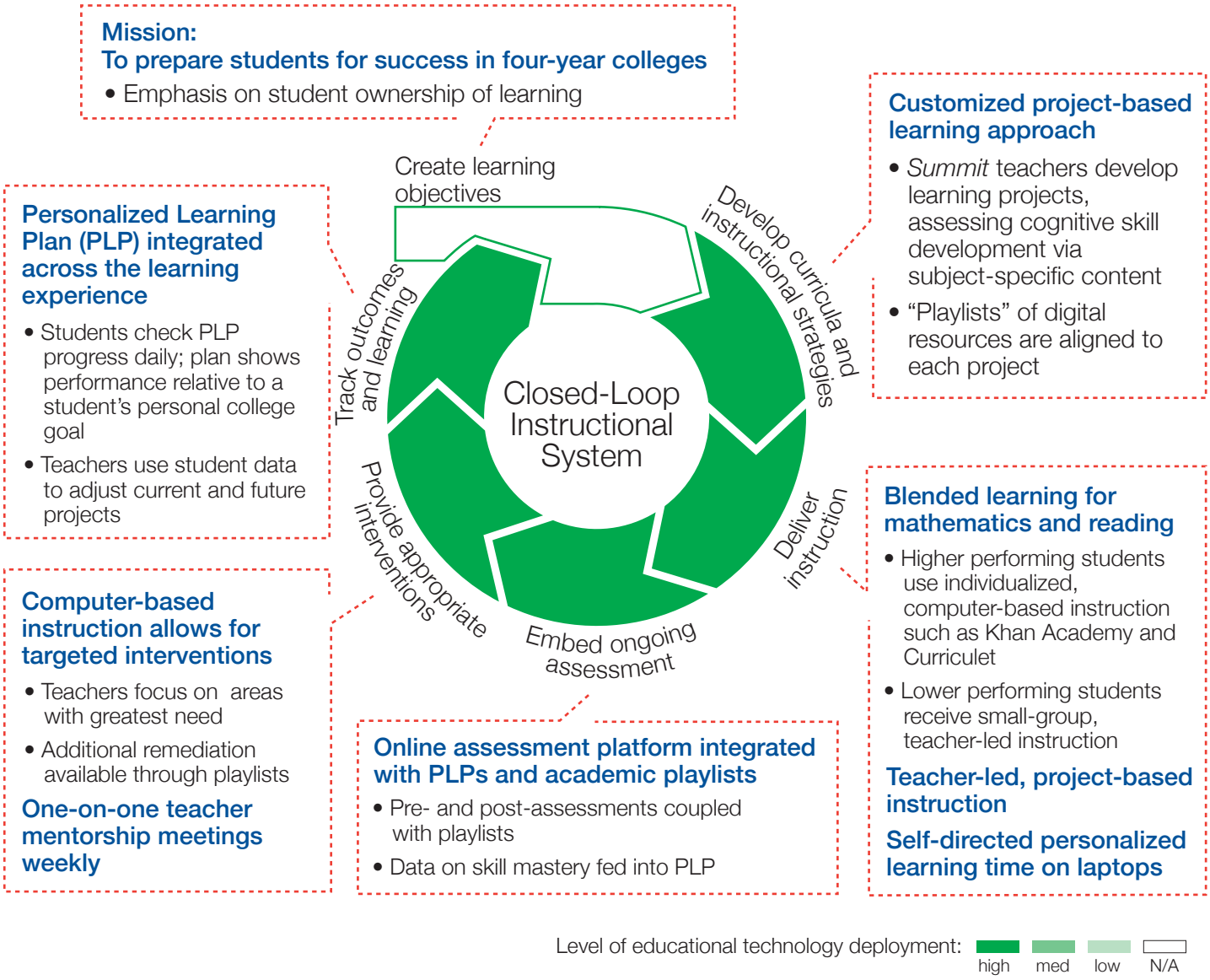
Summit's curricula features more than 200 activities that focus on developing skills such as problem-solving and communication, according to the organization. Project-based activities are mapped to a cognitive-skills rubric that is shared across all subject areas and grade levels. *Summit* assesses students on their development of cognitive skills through other activities, based on the rubric. Students submit all assignments using Google Docs to give feedback to each other and receive feedback from their teachers.

Summit's content curricula relies on in-house designed "digital playlists" for online, self-directed learning. Playlists include multiple types of internally and externally developed content, such as exercises, videos and quizzes, mapped to specific skills within its learning rubric. Students advance

[13] Bailey, Martha J. and Susan M. Dynarski. "Gains and Gaps: Changing Inequality in US College Entry and Completion." NBER Working Paper No. 17633. December 2011. (http://www.nber.org/papers/w17633) See also: http://www.mnprivatecolleges.org/sites/default/files/downloads/news/college_by_income.pdf.

[14] "Six-Year Degree Attainment Rates for Students Initially Enrolled in Four-Year Institutions." Pell Institute. December 2011. (http://www.pellinstitute.org/fact_sheets.shtml)

Exhibit 10: How *Summit Public Schools* uses education technology across the closed loop



through these playlists at their own pace, taking assessments as they feel ready. In addition to the playlists, students work on platforms such as Khan Academy to improve foundational literacies.

Thanks to specially designed performance tracking software known as a personalized learning plan (PLP), students evaluate their learning in real time and help set their learning goals for the week, month, semester and year with the help of a mentor with whom students meet weekly. In terms of assessment and progress tracking, *Summit* takes a unique approach: teachers work as coaches to help students interpret their successes and failures, learn how to set new plans and goals and push their skill development.

The PLP, assessments and measurements of skill growth are viewable by other grade-level teachers and administrators, which helps teachers and school leaders devise appropriate interventions to improve student outcomes. Parents can also log into the PLP to see a student's progress.

Students typically arrive at *Summit* schools with slightly lower scores than students at local high schools, yet outperform their peers during their time at its charter schools, according to the organization. *Summit* schools have consistently performed above California's measure of a successful school, with an average score of 826 on the state's Academic Performance Index (successful schools are defined as those scoring 800 or greater on the API test). Thanks to its college-prep-focused curricula in which every student takes six AP courses, 96% of *Summit* students are accepted to at least one four-year college or university. They complete college within six years at double the national average.

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Chapter 4: System-wide priorities for stakeholders

Students require new skills in the 21st century, while educators and other stakeholders require new measures of performance. Education technology has the potential to fundamentally increase efficiency and effectiveness throughout the closed loop, as well as a unique potential to facilitate the teaching of 21st-century skills beyond foundational literacies.

However, in most places, education technology has been deployed only recently, with outcomes highly dependent on how well technology can be integrated holistically to address an individual country's context. In the most developed countries, the primary focus should be on scaling successful approaches, while expanding technology's ability to address new skill needs such as competencies and character qualities. In the least developed countries, the development of foundational literacies is often a much more pressing problem. The main focus in many of these countries should be on adapting and experimenting with some of these promising, albeit early-stage technological solutions from the developed world.

To understand how stakeholders can move forward in many of these directions at once, it's helpful to come back to our closed-loop model. In addition to operating at the level of the classroom and the school network, the closed loop also operates systemically – whether at the country, state or the district level. For example, at the country level, policy-makers can help define the learning objectives and policies tied to the overall aspirations for a knowledgeable and economically productive citizenry. Educators then design the standards and specific curriculum, deliver selected models and assess their efficacy.

Policy-makers and educators have a particularly useful role to play at the system level in embedding 21st-century skills and education technology across the closed loop. But fulfilling the promise of the closed loop will require a multistakeholder approach involving not just policy-makers and educators, but also educational-technology providers and funds. These stakeholders can take a number of actions.

Stakeholder group	Primary role	Actions/capabilities needed
Policy-makers	• Assess and realign educational systems and standards for the development of 21st-century skills	• Agree on definitions and globally uniform standards to measure 21st-century skills • Incorporate all 21st-century skills into learning standards, including competencies and character qualities • Certify new instructional content such as OER and align it to 21st-century skills standards • Direct assessment towards 21st-century skills, incorporating new metrics beyond foundational literacies
	• Identify and prioritize key skills gaps, paying attention to the needs of local economies, available resources, and unique country-level constraints	• Track performance in relation to peers and over time • Prioritize gaps, set clear targets and develop action plans to address gaps and overcome country-level constraints • Work in collaboration with the private sector to improve skills critical to the workforce of the future • Create incentives for education technology providers to develop products and services that develop competencies and character qualities
	• Create a learning environment that supports innovation, both from schools and from education-technology players	• Give schools the autonomy to innovate while maintaining accountability for high learning standards • Provide funding for innovative school networks that demonstrate improved outcomes • Create a dialogue with innovative players to accelerate the spread of best practices into the mainstream

Stakeholder group	Primary role	Actions/capabilities needed
Educators (such as teachers, school principals and local and regional administrators)	• Scale up, transfer and promote the most successful models	• Scale up effective new models within countries by identifying core elements of success, securing stable funding sources, and creating a dialogue with policy-makers to ensure a continuous integration of innovative approaches into the mainstream • Promote and transfer effective models in new markets by standardizing key instructional and operational model elements, adapting to local needs, and using data to continuously track and compare both output and outcome metrics
	• Evaluate whether education technologies can be adopted throughout the closed loop, given unique country contexts	• Develop and promote understanding of and expertise in technology • Focus investment on the technology infrastructure with the strongest potential, such as the hardware necessary for blended instruction, effective computer-based learning programmes, and integrated assessment and data platforms • Ensure interoperability between instructional strategies, assessment systems and learning platforms to enhance decision-making related to students, teachers and administrators
	• Develop and promote technology expertise among teachers	• Incorporate 21st-century skills proficiency into teacher qualification and professional development • Provide teachers with ongoing support to effectively integrate technology solutions into the classroom
Education technology providers	• Develop products to fill gaps in 21st-century skills measurement and instruction	• Develop tools and business models that are financially viable in the developing world, that address its unique environment and constraints, and that work to overcome the digital divide • Build tools that go beyond foundational literacies and specifically target competencies and character qualities • Support the development of comprehensive global assessments and measurements for 21st-century skills
	• Help shape the public education agenda	• Engage in the public debate about education and promote the need for the development of skills most demanded in the job market • Promote the scaling up of proven innovations through partnerships, dialogue and advocacy
Funds and alliances	• Accelerate the development and implementation of global measures of 21st-century skills	• Support metrics development and greater integration of measurements for both 21st-century skills and factors that constrain their development • Help increase coverage and comparable performance data collection in developing countries • Provide the funding needed to research and develop metrics necessary to identify effective technology-based solutions at an early stage
	• Provide funding to pilot, transfer and scale up technology-enabled models	• Accelerate the migration of technology-driven models from developed to developing markets, once key instructional and operating features have been standardized and models have been adapted to local needs • Focus seed funding on solutions with both a high impact on outcomes and sustainable financial models • Invest in innovation incubators for education technologies in the developing world • Provide resources and advice to pilot technology-enabled models for the development of competencies and character qualities

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Appendix 1: Definitions of 21st-century skills

	Skill	Definition
Foundational literacies	**Literacy**	Ability to read, understand and use written language
	Numeracy	Ability to use numbers and other symbols to understand and express quantitative relationships
	Scientific literacy	Ability to use scientific knowledge and principles to understand one's environment and test hypotheses
	ICT literacy	Ability to use and create technology-based content, including finding and sharing information, answering questions, interacting with other people and computer programming
	Financial literacy	Ability to understand and apply conceptual and numerical aspects of finance in practice
	Cultural and civic literacy	Ability to understand, appreciate, analyse and apply knowledge of the humanities
Competencies	**Critical thinking/ problem-solving**	Ability to identify, analyse and evaluate situations, ideas and information to formulate responses and solutions
	Creativity	Ability to imagine and devise new, innovative ways of addressing problems, answering questions or expressing meaning through the application, synthesis or repurposing of knowledge
	Communication	Ability to listen to, understand, convey and contextualize information through verbal, nonverbal, visual and written means
	Collaboration	Ability to work in a team towards a common goal, including the ability to prevent and manage conflict
Character qualities	**Curiosity**	Ability and desire to ask questions and to demonstrate open-mindedness and inquisitiveness
	Initiative	Ability and desire to proactively undertake a new task or goal
	Persistence/ grit	Ability to sustain interest and effort and to persevere to accomplish a task or goal
	Adaptability	Ability to change plans, methods, opinions or goals in light of new information
	Leadership	Ability to effectively direct, guide and inspire others to accomplish a common goal
	Social and cultural awareness	Ability to interact with other people in a socially, culturally and ethically appropriate way

Sources: ESCO Skills Hierarchy for Transversal Skills (https://ec.europa.eu/esco/web/guest/hierarchybrowser/-/browser/Skill); Partnership for 21st Century Skills. "Framework for 21st Century Learning." NEXT: Washington DC, 2001; Burkhardt, Gina. "enGauge 21st Century Skills: Literacy in the Digital Age." North Central Regional Educational Laboratory and The Metiri Group, 2003. (www.ncrel.org/engauge); Learning Metrics Taskforce. "Towards Universal Learning: What Every Child Should Learn." Center for Universal Education at the Brookings Institution and UNESCO Institute for Statistics: Washington, DC, 2013; The Economist Intelligence Unit. "The Learning Curve: Education and Skills for Life." Pearson: London, 2014. Other sources considered but not included: AT21CS, WorldSkills, Iowa Dept. of Education's 21st Century Skills, and Tony Wagner's Seven Survival Skills.

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Appendix 2: The measurement challenge

Measuring 21st-century skills presents numerous obstacles. Researchers have access to only limited direct metrics to assess performance on the full range of skills. In addition, the coverage of these metrics is often confined to the developed world.

The majority of tests measuring 21st-century skills focus on foundational literacies. Beyond the indicators we used in our methodology – the Programme for International Student Assessment (PISA), the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) and the Latin American Laboratory for Assessment of the Quality of Education (LLECE) – other tests that measure literacy, numeracy and scientific literacy include the Progress in International Reading Literacy Study (PIRLS), the Early Grade Reading Assessment (EGRA), the Program for the Analysis of Education Systems (PASEC) and the Trends in International Mathematics and Science Study (TIMSS).

The three other literacies – financial, ICT and cultural and civic – have not been part of the traditional focus of international assessments and therefore there is less data and fewer assessments available to draw on. The only test currently available for financial literacy is PISA, but that test covers only 16 countries. For civic and cultural literacy, we evaluated two direct measurements, the International Civic and Citizenship Education Study (ICCS) and the Civic Education Study (CivEd). We picked ICCS for its wider coverage. Finally, we used PISA's digital literacy assessment, which is a valuable assessment but has limited global coverage.

We found large gaps in coverage in the measurement of many core skills. When we combined existing metrics for literacy and numeracy, for example, we were able to cover fewer than half of the countries in the world.

Measurement challenges are amplified when it comes to competencies and character qualities. PISA has pioneered the assessment of problem-solving, a key competency. This assessment still covers only approximately 44 countries. For creativity, communication and collaboration, no direct measurements exist to date. For creativity, we used a proxy from one of the sub-scores in PISA's mathematics assessment.[15] We encountered difficulties finding metrics that measure character qualities, with the exception of curiosity. For that metric, we used PISA's problem-solving subscale.[16]

Note that PISA is in the middle of promising work to extend its 2015 and 2018 assessments. It plans to add collaborative problem-solving and global competencies, measuring skills such as intercultural understanding, empathy and perspective taking.

It is critical that countries support and facilitate research to improve both the direct measurement of 21st-century skills as well as their global coverage. Only then will countries be able to create an accurate baseline from which to measure progress in the future.

[15] PISA 2012 mathematics subscale: "For individuals to use their mathematical knowledge and skills to solve a problem, they often first need to translate the problem into a form that is amenable to mathematical treatment. The framework refers to this process as one of formulating situations mathematically. In the PISA assessment, students may need to recognize or introduce simplifying assumptions that would help make the given mathematics item amenable to analysis. They have to identify which aspects of the problem are relevant to the solution and which might safely be ignored. They must recognize words, images, relationships or other features of the problem that can be given a mathematical form; and they need to express the relevant information in an appropriate way, for example in the form of a numeric calculation or as an algebraic expression."

[16] PISA 2012 Creative Problem Solving, acquisition of knowledge subscale: "In knowledge-acquisition tasks, the goal is for students to develop or refine their mental representation of the problem space. Students need to generate and manipulate the information in a mental representation. The movement is from concrete to abstract, from information to knowledge. In the context of the PISA assessment of problem solving, knowledge-acquisition tasks may be classified either as "exploring and understanding" tasks or as "representing and formulating" tasks."

Appendix 3: Indicators considered and used in the report

Indicators considered and used to estimate skills gaps:

	Skill	Indicator	Source
Foundational literacies	**Literacy**	• **Mean PISA 2012, 2009 reading score** • **Mean SACMEQ III reading score** • **Mean LLECE reading score** • Mean PIRLS literacy score • Mean EGRA score • Mean PASEC reading score • Youth literacy rate	• **OECD** • **UNESCO (IIEP)** • **UNESCO** • IEA • USAID (funded) • UNESCO (IIEP) • UNESCO
	Numeracy	• **Mean PISA 2012, 2009 mathematics score** • **Mean SACMEQ III mathematics score** • **Mean LLECE mathematics score** • Mean TIMSS mathematics score • Mean EGMA score • Mean PASEC mathematics score • Quality of science and mathematics education index	• **OECD** • **UNESCO** • **UNESCO** • IEA • USAID (funded) • UNESCO (IIEP) • WEF
	Scientific literacy	• **Mean PISA 2012, 2009 science score** • **Mean LLECE science score** • Mean TIMSS science score • Quality of science and mathematics education index	• **OECD** • **IEA** • UNESCO • WEF
	ICT literacy	• **PISA 2012 Digital Reading Assessment** • Students per computer in school • Students per web-enabled computer • Internet access in schools (Global Competitiveness Index) • Percentage of schools with shortage of internet connectivity (PISA 2012 School Questionnaire) • Percentage of schools with shortage of computers for instruction (PISA 2012 School Questionnaire)	• **OECD** • UNESCO • UNESCO • WEF • OECD • OECD
	Financial literacy	• **PISA 2012 Financial Literacy Index**	• **OECD**
	Cultural and civic literacy	• **ICCS score** • CivEd test score • World Governance Indicators: Rule of Law, Voice and Accountability and Government Effectiveness • Percentage of students communicating with parents about social and cultural issues • Percentage of students with possessions related to classical culture • Frequency of going to cinema, live performances, cultural sites or attending live sport events	• **IEA** • IEA • World Bank • EU (Eurostat data)
Competencies	**Critical thinking/ problem-solving**	• **PISA 2012 Problem-Solving score**	• **OECD**
	Creativity	• **PISA 2012 mathematics formulate subscore** • International Innovation Index • Global Innovation Index • Global Creativity Index • Creative Class Share	• **OECD** • BCG, NAM • INSEAD, WIPO • MPI • MPI
	Communication	• *No indicators available*	• N/A
	Collaboration	• Self-reported score on university-company research collaboration • Self-reported score on cooperation in labour employment relations	• World Bank

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Character qualities

Skill	Indicator	Source
Curiosity	• **PISA 2012 Problem-Solving – Acquisition of Knowledge Subscale**	• **OECD**
Initiative	• Total early stage entrepreneurial activity (% of working age population both about to start an entrepreneurial activity and that have started one from a maximum of three and a half years) • Established business ownership rate (% of 18-64 population who are currently owner-manager of an established business) • National Expert Survey Index (combination of indicators with significant impact on national entrepreneurship)	• GEM
Persistence/grit	• Self-reported measure of perseverance (PISA Student Questionnaire) • Total Early Stage Entrepreneurial Activity (GEM)	• OECD
Adaptability	• *No indicators available*	• N/A
Leadership	• Quality of management schools (2010) • Reliance on professional management (2010)	• World Bank
Social and cultural awareness	• Ethnic fractionalization index (2003) • Cultural diversity index (2003)	• James Fearon, Stanford University

Factors influencing indicator selection include broad country coverage, direct skill measure and independent assessment.

***bold** denotes indicator selected to measure skill performance*

Indicators considered and used to estimate educational factors holding countries back:

Education factors	Definition	Indicators
Policy Enablers	Standards that govern K-12 education	• **Number of years of mandatory education (UNESCO)** • Satisfaction with education policy
Human Capital	Teacher quality, training and expertise	• **Number of students per trained teacher, primary**[17] • Number of students per trained teacher, secondary • Number of students per teacher • Teachers working in schools that use some kind of formal appraisal • Average years of working experience as a teacher in total • Teachers who report high need to develop ICT skills for teaching (%) • Teaching time per week (hours) Ideal quality metric would have included: • % of teachers coming from top tier universities • salary data for teachers relative to other jobs with same qualifications
Financial Resources	Importance of education in public budgets	• **Government expenditure per primary student (constant PPP$) (UNESCO)** • Government expenditure on education as % of GDP (%) • Government expenditure per secondary student (constant PPP$)
Technological Infrastructure	Access to new digital tools and content via the internet	• **Internet access in schools (World Economic Forum)** • Mobile broadband penetration • Household broadband penetration • Population using the internet (%)

Other factors, such as socioeconomic status and conflict, also present significant challenges to educational attainment.

***bold** denotes indicator selected to measure skill performance*

Sources: OECD, UNESCO, American Educational Research Association.

[17] Calculated using UIS data: Enrollment in primary education [number] / (teachers in primary education [number] x teachers in primary education who are trained [%]). Calculated using Teacher Quality Opportunity Gap and National Achievement data for countries without UIS data for primary teacher education rates.

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Appendix 4: Countries with available skill data included in the report

High-income OECD	High-income non-OECD	Upper-middle income	Lower-middle income	Low-income
Australia	Shanghai-China[18]	Albania	El Salvador	Kenya
Austria	Croatia	Argentina	Georgia	Malawi
Belgium	Cyprus	Azerbaijan	Guatemala	Mozambique
Canada	Hong Kong	Botswana	Indonesia	Tanzania
Chile	Latvia	Brazil	Kyrgyzstan	Uganda
Czech Republic	Liechtenstein	Bulgaria	Lesotho	Zimbabwe
Denmark	Lithuania	Colombia	Moldova	
Estonia	Macao	Costa Rica	Nicaragua	
Finland	Malta	Dominican Republic	Paraguay	
France	Qatar	Ecuador	Swaziland	
Germany	Russia	Hungary	Vietnam	
Greece	Singapore	Jordan	Zambia	
Iceland	Trinidad and Tobago	Kazakhstan		
Ireland	United Arab Emirates	Malaysia		
Israel	Uruguay	Mauritius		
Italy		Mexico		
Japan		Montenegro		
Luxembourg		Namibia		
Netherlands		Panama		
New Zealand		Peru		
Norway		Romania		
Poland		Serbia		
Portugal		Seychelles		
Slovak Republic		South Africa		
Slovenia		Thailand		
South Korea		Tunisia		
Spain		Turkey		
Sweden				
Switzerland				
United Kingdom				
United States				

Sources: World Bank; project team analysis.

[18] Shanghai is grouped in high-income non-OECD due to its income level. (PISA reports China data for Shanghai only.)

Appendix 5: A comparison of performance data across tests

Many countries use widely varying measures to assess similar skills, making comparisons between countries' absolute scores on comparable tests difficult. To increase the number of countries with comparable data for literacy, numeracy and scientific literacy, we conducted a crosswalk analysis, which allows researchers to compare results on tests of comparable skills that use widely different scales.

For countries in Africa and Latin America that had taken only the SACMEQ or LLESE tests and not the PISA test, we devised a way to convert those region-specific test scores into the equivalent of PISA scores. We looked at the handful of countries in those areas that had taken both PISA and either of the SACMEQ or LLESE tests in 2009 or 2012, in order to calculate an average conversion factor from one of the two regional tests into PISA. We then applied that conversion factor to SACMEQ and LLESE scores to translate them into PISA scores. Since we did not have access to the raw data, we assumed that the statistical distribution of the converted scores corresponded to the distribution of the original scores.

The methodology allowed only for a ranking-based comparison of the countries studied, not an absolute score assessment. We therefore have not provided the converted scores for comparison but rather used percentile ranks. This approach draws on the more advanced methodology demonstrated by Altinok and Murseli,[19] as well as Hanushek, Peterson and Ludger,[20] and it is intended to provide an indicative comparison among countries rather than a rigorous assessment of relative performance.

As a result of the analysis, we increased the sample size from 72 to 91 countries. In particular, coverage for the lower-middle-income cluster increased from two to 12 countries and coverage for the low-income cluster increased from zero to six countries.

[19] Altinok, Nadir and Hatidje Murseli. "International Database on Human Capital Quality." Economics Letters 96, no. 2. 2007; Altinok, Nadir. "A New International Database on the Distribution of Student Achievement." 2011. United Nations Educational, Scientific and Cultural Organization (UNESCO).

[20] Hanushek, Eric A., Paul E. Peterson and Ludger Woessman. "Achievement Growth: International and U.S. State Trends in Student Performance." Harvard Kennedy School of Government. 2012.

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IBSC International Boys' Schools Coalition

2015 Australia New Zealand Regional Conference

Leading and Learning Through Service

Churchie.

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Message from the Churchie Headmaster

Churchie is delighted to be convening this conference for educators of boys' schools across Australia and New Zealand, on behalf of the International Boys' Schools Coalition.

The central theme of Leading and Learning through Service focuses on exploring how serving others in local, national and international communities can develop leadership skills, resilience and well-rounded character in young people. Further, that embracing a service and volunteering mindset will enable a young person to know about themselves and other people within and beyond their communities. Many schools recognise their responsibility to offer a range of service-based activities to teach young people important life lessons about how they might positively influence their world, develop their own resilience and emotional intelligence and, ultimately, their character.

A diverse array of presenters will explore this central theme by sharing their own observations and insights from service experiences in life; how their character and leadership skills benefited from serving others and the links between their professional lives and the time spent being of service to others in local, national and international communities. On behalf of the Churchie and wider educational community, I sincerely thank the members of the organising committee.

I wish you an engaging and professionally rewarding conference experience at Churchie.

Best regards

Dr Alan Campbell
Headmaster, Churchie

Message from the Regional Vice President – IBSC

The Australia New Zealand region of the International Boys' Schools Coalition is pleased to invite you to our second regional conference to be hosted by the Anglican Church Grammar School, Churchie, in Brisbane, Queensland. I hope all educators focused on the development of boys will find the theme and purpose of the conference, which is about 'service', of interest. Dr Alan Campbell and his IBSC organising committee have done a wonderful job in collecting a diverse range of speakers and are looking forward to a great deal of sharing and growth for all participants. Brisbane in April is always beautiful and I know that Churchie will be exemplary hosts.

Best regards

Garth Wynne
Regional Vice President, Australia New Zealand IBSC
Headmaster, Christ Church Grammar School

Keynote Speaker

Mr Daniel Keighran VC

Daniel was born in Nambour, Queensland and grew up in Lowmead , a small town approximately 80 kilometres from Bundaberg, and began his career in the Australian Army at the age of 17 and served for 14 years. During his career, he served with Delta Company, the 6th Battalion, Royal Australian Regiment (6RAR) – a Company that is engraved in Australian military history. He has been deployed in Afghanistan, Iraq and East Timor.

In 2010 Daniel was deployed on his second tour of Afghanistan. Whilst on the outskirts of the village of Derapet, his patrol came under heavy fire by a numerically superior insurgent force. After receiving a friendly casualty, Daniel acted on his own initiative and took decisive action to turn the tide of battle.

This decision would see him risk his life and purposefully draw enemy fire to himself and away from the rest of the members of his patrol who were treating the casualty. This firefight and his actions would continue for over three hours.

In 2012 Daniel was awarded Australia's 99th Victoria Cross, making him one of only nine living Victoria Cross recipients in the world – this is the first and only Victoria Cross awarded to a soldier serving the Royal Australian Regiment in its 66 year history. His citation read: 'For the most conspicuous acts of gallantry and extreme devotion to duty in action in circumstances of great peril'.

In 2011 Daniel discharged from full-time Army service and commenced a career in the mining industry and continues to serve in the Army Reserves. He is also an Ambassador for the Australian Defence Force Assistance Trust. He is a leader who knows what is required to motivate members of his team. Daniel talks about service, leadership, teamwork and making decisions under pressure.

Key Speaker Profiles

Mr Peter Hunt AM

Peter is one of Australia's leading investment bankers and an active philanthropist. He is the Chairman and one of the original founders of Greenhill Australia.

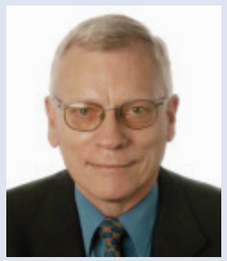
In the not-for-profit sector he is the Chairman of Grameen Foundation Australia and So They Can - which focus on poverty alleviation in Asia and East Africa respectively, and he works with Indigenous Australians in the Northern Territory. He is a Trustee of the Anindilyakwa Indigenous Mining Trust and a co-founder of Manly Women's Shelter and founder of Women's Community Shelters (both focused on helping homeless women).

Peter was awarded his AM in 2010 for services to the philanthropic sector.

Professor David Walker

David is one of Queensland's leading specialists in neuro-oncology. He sees brain cancer affect ordinary people on a daily basis and this has fuelled his crusade to find a cure. He holds a PhD in the Molecular Genetics of Astrocytomas (brain tumours).

He has held numerous teaching and clinical positions in domestic and foreign universities and hospitals, the Queensland Institute of Medical Research, the University of Bochum (Germany) Brigham and Women's Hospital (Boston) and Harvard University (Boston). David is a currently also a Professor in the medical faculty at Queensland, Griffith and Bond Universities. As Managing Director of the Newro Foundation he spearheads fundraising campaigns and leads clinical trials with his team of research nurses. He is also a volunteer with the Ecumenical Coffee Brigade.



Mr Greg Vickery AO

Greg is a Special Counsel at global corporate law firm Norton Rose Fulbright, a former President of the Queensland Law Society and an Adjunct Professor in Law at the University of Queensland (UQ). From 1999-2007 he was the Honorary Consul for Indonesia in Queensland and for 20 years he has been an active member of the Australian Indonesian Business Council.

Greg has been a voluntary member of the Australian Red Cross for over 40 years, including service as the National President (2003-11) and is currently Chairman of the Standing Committee of the Red Cross and the Red Crescent Societies, an international body. He was awarded an AM in 2001 for service to law and legal education and in 2013 he was awarded an AO for his contribution to governance and leadership of humanitarian aid organisations.

Professor Con Stough

Con is Professor of Psychology at Swinburne University and a recognised leader in research focused on emotional intelligence. Over the past five years Professor Stough has developed measures of emotional intelligence for both primary and secondary students and intervention programs aimed at improving emotional competencies, improving scholastic success and well-being across all school ages. Professor Stough and Churchie have worked together as strategic partners and are forming an international alliance of schools interested in assessing and developing emotional intelligence. One of the goals of this alliance is in preparing the next generation of highly effective transformational leaders for society.

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Conference program

Thursday 16 April 2015

2.30 pm	Registration Opens Afternoon Tea
3 pm	Welcome Address Dr Alan Campbell, Headmaster
3.15 pm	IBSC Address Mr Garth Wynne, Regional Vice President, Australia New Zealand IBSC
3.30 pm	Keynote Speaker Mr Daniel Keighran VC
4.30 pm	Conference and Workshop Briefings
4.45 pm	Bond University Presentation Ms Catherine O'Sullivan Pro Vice-Chancellor, Pathways and Partnerships
5 pm	Welcome Cocktail Reception Magnus Quad Sponsored by Bond University
7 pm	Transport to Hotels

Friday 17 April 2015

8.15 am	Transport from Hotels
9 am	*Leading and Learning from the International Red Cross and Red Crescent Movement* Mr Greg Vickery AO
10 am	Morning Tea Magnus Quad Cloisters
10.30 am	*Using Engaged Philanthropy to Solve Entrenched Social Problems* Mr Peter Hunt AM
11.30 pm	Workshop Session One *Sharing Conversations on Service*
1.30 pm	Lunch Magnus Quad Cloisters
2.30 pm	*Developing Emotional Intelligence Competencies to be an Effective Service Leader* Professor Con Stough Swinburne University, Melbourne
3.30 pm	Furnware Presentation Mr Matt Diener Business Development Manager
3.40 pm	Afternoon Tea Magnus Quad Cloisters
4 pm	Transport to Hotels
6.30 pm	Conference Pre Dinner Drinks Room Three Sixty, Queensland University of Technology, Gardens Point Sponsored by Furnware Dress – Lounge Suit
7.30 pm	Conference Dinner Room Three Sixty, Queensland University of Technology, Gardens Point Dress – Lounge Suit

Saturday 18 April 2015

9 am	Transport from Hotels
9.30 am	*What Brain Surgery has Taught Me* Professor David Walker
10.30 am	Morning Tea Magnus Quad Cloisters
11 am	Workshop Session Two *Sharing Conversations on Service*
12 pm	Closing Comments and Vote of thanks Dr Alan Campbell, Headmaster
12.30 pm	Lunch Magnus Quad Cloisters
12.45 – 3 pm	Optional – School Tours

Registration

Registration

Via Online Payments, www.churchie.com.au
IBSC Member - $385.00 (inclusive of GST)
IBSC Non-Member - $440.00 (inclusive of GST)

Accommodation

Delegates are encouraged to take advantage of special rates negotiated with Quay West Suites and Stamford Plaza.

Quay West Suites: $249.00 per night
Stamford Plaza: $270.00 per night

Bus Transportation will be provided to/from Churchie for conference sessions. Ask for the IBSC conference rate when booking, as a limited allocation of rooms is available.

Conference Dinner

Room Three Sixty, QUT Gardens Point
Bookings made via Online Payments, www.churchie.com.au
$150.00 per person

Organising Committee

Mr Andrew Wheaton – Deputy Headmaster – Academic
Mr Ian Macpherson – Acting Deputy Headmaster – Operations
Mrs Elizabeth Stannard – Director of Business and Finance
Mr John Collins – Director of Service
Mr Tony Rowan – Teacher of English
Mr Brian Bowen – Events Production Manager
Mrs Diane Cross – Event Director
Ms Jessica Lunney – Event Coordinator

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POST, April 25, 2015 – Page 11

Christ Church says time for new head

Christ Church Grammar School's council decided not to renew principal Garth Wynne's contract this week.

Mr Wynne's 15-year career at the Claremont school will finish at the end of the year.

Council chairman John Poynton said he hoped the new headmaster would be in place by the start of next year.

"The school council, after discussions with Garth, has decided that after 15 years of exemplary service and at the conclusion of Garth's third contract, this is a logical point for leadership renewal," Mr Poynton said.

He praised Mr Wynne's achievements, including seeing Year 7 into senior school, the start of an indigenous student program, and establishing centres of excellence.

"Garth has overseen a program of physical renewal on our campuses and sustained the highest quality outcomes for the boys and staff," Mr Poynton said.

He said the council had immense gratitude to Mr Wynne, who is the school's second-longest serving principal.

Mr Wynne said: "It has been a very good conversation between the council and me.

"I look forward to the challenges ahead."

OLD. B09 - Graham Forward

Walk the beach here to help children in Africa

A walk along the beach next Sunday will raise funds to help Australian doctors treat African children with club foot.

Called the Little Feet Walk, the fundraiser will leave from the grassed area north of North Cottesloe Surf Life Saving Club at 9am on May 3.

It costs $25 to correct one child with club foot and there will be a trophy for the person who supports the most children.

People can walk either 5km or 10km and registrations open at 8.30am.

There will be a sausage sizzle back at the start from 10 to 11am.

The event is being run by Australian Doctors for Africa (ADFA), which was founded 10 years ago by Peppermint Grove orthopaedic surgeon Graham Forward.

ADFA sends volunteer medical teams to Ethiopia, Madagascar, Somaliland and the Comoros Islands as well as providing medical equipment and upgrading buildings.

Australian specialists also train local medical staff.

To help the cause, join the beach walk next Sunday.

LEFT: Ready to walk along the beach next Sunday are, from left, Sami Tadros, Genevieve Ellison, Jeanne Bell and Jill Goetze. They are supporting Australian Doctors for Africa, including Dr Homar, whose journey is outlined below.

Doctor proud to help his own people

For one obstetrician on the Australian Doctors for Africa (ADFA) team that went to Madagascar last month, the project was a dream come true.

His trip was supported by events like next weekend's Little Feet Walk at Cottesloe.

Lanziz Homar was born in Madagascar and grew up there in the 1980s with his mother, who was from a poor family.

"Food, food and food was all I could dream about during those times," he said.

Later he dreamt of being able to help his family, and so going back to his homeland with a medical team in March was close to that dream of 30 years ago.

Lanziz went to military school in Madagascar to finish high school and then studied medicine in Antananarivo, Madagascar's capital.

He married a visiting medical student, Marni, and moved to Australia with her.

After learning English, he was able to practise and study in Australia and always dreaming of giving something back to his country.

"I read about Australian Doctors for Africa and knew this was the organisation I needed to approach," he said.

He wrote to the president of the group, Peppermint Grove orthopaedic surgeon Graham Forward, who welcomed him on the team heading for Madagascar.

"He told me how he had travelled to Madagascar for the first time in the 1980s and seen the poor health system affecting the most vulnerable people of Madagascar, which then inspired him," Lanziz said.

"After listening to someone like him, who doesn't have any family over there but is determined to help the poor people, it more than inspires.

"It was impressive to learn about other members of the team, the sacrifice they made by being away from their family and the preparation they had to do before leaving for Madagascar."

Jeanne Bell from Australian Doctors for Africa said Lanziz was the first obstetrician and gynaecologist to go to Madagascar with ADFA.

"Obstetrics and gynaecology go hand in hand with our club foot in newborns program in paediatrics," she said.

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Post April 25, 2015

Lemons sweeten zoo life

By LINDA CALLAGHAN

A Dalkeith lemon tree and schoolboy Andrew Triglavcanin are helping save endangered turtles.

Andrew sells the lemons from the tree in his garden and donates the money to Perth Zoo to help the western swamp turtle.

Environment Minister Albert Jacob invited him to the zoo on Wednesday morning to see the new breeding centre that Andrew helps.

"We used to give the lemons away and I asked Mum if I could sell them," Andrew said.

The tree in Robert Street fruits most of the year and Andrew runs an honour system so neighbours can leave donations and help themselves.

So far he has raised about $400.

Andrew's love of wildlife comes from some of the adventure holidays he and his family have taken.

They have been to the Amazon, the Galapagos Islands and Madagascar.

He has been piranha fishing in South America and on safari in South Africa.

Later in the year they are off to Norway for a polar bear holiday.

"I want to go to Papua New Guinea because they have some really big insects there," Andrew said

He and his sister Olivia (15) have different ideas.

"Holidays are a balance between animals and shopping," said Andrew, a student at Christ Church Grammar School.

Sweet success ... *Andrew Triglavcanin has sold lemons from the family's tree to raise about $400 for a western swamp turtle breeding program at Perth Zoo.* **Photo: Billie Fairclough**

WESTERN SUBURBS APRIL 21 - 27.

Sir Charles Court Young Leaders Program participants Andrew Burvill (Scotch College), Pria Castle (Shenton College), Hannah Johns (Presbyterian Ladies' College), Luke Thomas (St Georges Anglican Grammar School), Shannon Viall (International School of Western Australia) and Keaton Wright (Christ Church Grammar School).

Students lead way at program

STUDENTS chosen for the Sir Charles Court Young Leaders Program held last week could be the leaders of tomorrow.

Five students from the western suburbs were selected to take part in the Curtin University program, which is based on the shared ideals of Sir Charles Court and former Prime Minister John Curtin, of vision, leadership and community service.

They attended an intensive four-day leadership camp where they were exposed to challenging activities aimed at developing their leadership skills and building confidence in their own abilities.

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Western Suburbs April 21-27

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Experiment starts a conversation about trust

JASIRAH Bin Hitam has completed a blind social experiment to facilitate a conversation about trust between Indigenous and non-Indigenous Australians.

The video, which shows the 18-year-old from Broome standing blindfolded on Cottesloe Beach on March 19 with a sign that reads: "I trust you, do you trust me? Let's Hug", has since been viewed 550,000 times.

"I was so nervous and the first five minutes of standing there went forever and the whole thing was very emotional," Ms Bin Hitam said.

She said the response from the video was very encouraging.

She said her alarming statistic at the end of the video – in 2012, 13 per cent of all Australians said they trust Aboriginal and Torres Strait Islanders – helped facilitate positive conversations about change.

Jasirah Bin Hitam receives a hug during her experiment on Cottesloe Beach.

"I have had multiple conversations with people about the statistic and they were shocked, then the conversation opened up to how to change it," Ms Bin Hitam said.

Indigenous Communities Education and Awareness (ICEA) Foundation chief executive Lockie Cooke said the video was important to start the conversation about change.

"It's so powerful to have created something that has been so popular in our community, which inspires us to continue the work we've been doing in the reconciliation space," Mr Cooke said.

"Jasirah's story is a true success of the ICEA Foundation and she truly is an inspiration to all of us at ICEA and everyone she connects with."

Shannan Osrin

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PUSH FOR STUDENTS

Top Perth schools splash out

Bethany Hiatt
Education Editor

Perth's elite independent schools are spending millions of dollars a year on upgrades to decades-old classrooms and sports facilities to help them attract students.

Figures from the Federal Government's My School website — updated this month — show that some of WA's most expensive schools spent more than $15 million in 2013 and more than $40 million in the five years from 2009.

Wesley College headmaster David Gee said high-fee schools needed something to show parents why they charged more than $20,000 a year.

"We are under increasing pressure to create a point of difference from a value perspective, and buildings are what people can see," he said.

Wesley spent $27 million between 2009 and 2013 on refurbishing heritage-listed classrooms, building a new middle school block and a gymnasium extension. "I wouldn't say they're bells and whistles projects, they're projects focused on enhancing learning," Mr Gee said.

"We haven't spent the money on sport that some schools have."

Stephen Webber, headmaster of Guildford Grammar School, which spent more than any other school from 2009 to 2013, said it had invested in an extensive building program because enrolments had grown about 50 per cent in the past decade.

Though the My School website says Guildford spent $54 million in that time, Mr Webber said the school had submitted incorrect data and he would request the total be changed to $46 million.

A senior school block of 22 classrooms opened in 2013 and another 20 classrooms were being built at the preparatory school. Mr Webber said the life span of a specialist facility such as a performing arts centre was about 30 to 40 years.

At Scotch College, which spent $36 million during the same period, the biggest investments were a new middle school with 22 classrooms, a library and arts rooms.

"We have to offer modern, progressive facilities," headmaster Alec O'Connell said.

Hale School headmaster Stuart Meade said most of its $43 million investment was spent on a new middle school and an aquatic centre.

SCHOOL UPGRADES

School	Capital expenditure 2009-13
Guildford Grammar School	$46,721,036
Hale School	$43,368,679
St Hilda's Anglican School for Girls	$37,167,637
Scotch College	$36,169,731
Christ Church Grammar School	$29,139,753
Wesley College	$27,112,307
St Mary's Anglican Girls' School	$26,238,389
Penrhos College	$24,695,254

SOURCE: MYSCHOOL.EDU.AU

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MAKE SMOKING HISTORY WAGIN WOOLORAMA

Woolora

Exciting times at Christ Church

JANE Kilpatrick (centre), Wagin and her daughter Edwina (8) caught up with Christ Church Grammar School house mother Jenny Watts at last week's Make Smoking History Wagin Woolorama.

Ms Kilpatrick has a son who will start at Christ Church as a boarder next year and always relishes the opportunity to meet with school staff to see what's new in terms of the curriculum and school boarding facilities.

"It's such an exciting time for our kids who are going away to school," she said.

CHRIST CHURCH GRAMMAR SCHOOL

"And having the opportunity to spend some time with the people who will be nurturing our children is invaluable."

Ms Watts said there is never a dull moment when it comes to boarding at Christ Church and the students form life-long friendships, develop independence and learn the importance of co-operation and empathy for others in their home away from home.