Charles Leadbeater

THE PROBLEM SOLVERS

The teachers, the students and the radically disruptive nuns who are leading a global learning movement

Open Ideas at Pearson
Sharing independent insights on the big unanswered questions in education

Pearson

THE PROBLEM SOLVERS

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About the Author

Charles Leadbeater is a leading authority on innovation and creativity. He has advised companies, cities and governments around the world on innovation strategy and drew on that experience in writing his latest book We-think: the power of mass creativity, which charts the rise of mass, participative approaches to innovation from science and open source software, to computer games and political campaigning.

Charles has worked extensively as a senior adviser to the governments, advising the 10 Downing St policy unit, the Department for Tradeand Industry and the European Commission on the rise of the knowledge driven economy and the Internet, as well as the government of Shanghai. He is an advisor to the Department for Education's Innovation Unit on future strategies for more networked and personalised approaches to learningand education. He is a co-founder of the public service design agency Participle.

A visiting senior fellow at the British National Endowment for Science Technologyand the Arts, he is also a longstanding senior research associate with the influential London think-tank Demos and a visiting fellow at Oxford University's Said Business School and the Young Foundation. He is co-founder of Participle, the public service innovation agency, which is working with central and local government to devise new approaches to intractable social challenges.

His published works include *We-think, Living on Thin Air, Up the Down Escalator* and *In Search of Work.*

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Suggested reference: Leadbeater, C (2016). The Problem Solvers: The teachers, the students and the radically disruptive nuns who areleading a global learning movement. London: Pearson.

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ISBN: 9780992425654

Designed and typeset by Soapbox, www.soapbox.co.uk

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Acknowledgements

In writing this paper I had the good fortune to be able to draw on the ideas and insights of many people.

Some of the most powerful ideas came from the innovative and skilled practitioners I met who are developing more effective approaches to learning, including: Peter Hyman, Ron Berger, Douglas Archibald, John Baumber, Sir Mark Grundy, Gwyn ap Harri, Keith McDougall, Sister Monika Horch, Tim Jones, Barbara McKeon, Peter Hutton, Tom Sherrington, the principals and staff at Bekemaschool in Amsterdam and at Strandvej, in Ishøj, Copenhagen.

I also benefitted from lengthy conversations with Manuel Toscano and Clare Watson-Bartolomei at Zago, in New York and the education team at Kennisland, the Dutch think tank, who kindly organised a workshop with a clutch of innovative schools.

I also need to thank the organisers of three conferences for giving me the opportunity to try out my ideas with their audiences. Valerie Hannon, Tony McKay and David Albury, the forces behind the Global Education Leaders Programme, gave me the chance to address their conference in Auckland in 2015, sponsored by the New Zealand Ministry of Education. The team at LeapEd Services, developing Trust Schools in Malaysia, invited me to talk at a conference in Kuala Lumpur in late 2015. A very early draft of these ideas was presented to the Schools, Students and Teachers Network (SSAT) conference in 2014. Thanks to Sue Wilkinson and Tom Middlehurst for inviting me to speak.

I also learned a lot from other people writing in this field, including Charles Fadel, John Hattie, Peter Hill, Geoff Masters, Yong Zhao, Andreas Schleicher, Tony Wagner, Linda Darling-Hammond and Ron Berger. I owe special thanks to the research team at Pearson who commissioned me to write this paper and who then helped me with extensive feedback on earlier drafts, especially Laurie Forcier, Mark Griffiths, Vikki Weston and my long-time sparring partner, Michael Barber. Thanks also to Lindsay Eichler for her assistance in developing the discussion questions found throughout the paper, and to Alex Brown for his diligence in compiling the many references and resources, as well as the school profiles. Finally, thanks to the team at Soapbox for their partnership in conceptualising the dynamic learning visualisations and developing the overall design. Errors and omissions are all my own.

Executive Summary

The core purpose of education needs to shift – from teaching students to follow instructions to preparing students to identify and solve problems.

Following instructions has been at the core, and has driven the success, of mass education. Yet in a more volatile, uncertain world, characterised by innovation and entrepreneurship, we now need to equip young people to solve problems of all shapes and sizes. Problems that will not come with instructions.

To make that shift, education systems need to provide dynamic experiences for young people through which they can learn in practice how to deploy knowledge in action, to work with others and to develop critical personal strengths such as persistence and resilience, to learn from feedback and overcome setbacks.

Providing a dynamic mix of theory and practice will require more than adding courses in entrepreneurship to our current systems of academic instruction. Nor will it be sufficient to introduce critical thinking modules into a curriculum designed to prepare students for standardised tests. The shift from "following instructions" to "solving problems" will require a much more comprehensive change in what students learn and how they learn it.

Education will need to develop creative, critical thinking and collaborative skills, and build vital attributes such as curiosity, courage and resilience.

To do so, education needs to become a dynamic activity, providing a combination of four elements:

- Knowledge, starting with the basic skills of literacy and numeracy, moving on to knowledge of core content and then to higher-order concepts and thinking skills, to challenge, question and adapt knowledge.

- Personal strengths and character development, including helping students find a sense of purpose and ambition, and to build their resilience and persistence.

- Social experiences so they deepen their relationships with others, learn through dialogue and collaboration, and take action together to make and do things, for and with other people.

- Activities that give students a strong sense of agency, so that they learn how to turn knowledge and ideas into action, to see that they can make a difference to the world.

Each element matters in its own right. Yet it is their dynamic combination that brings them to life. The elements become powerful when young people learn to develop and deploy them together. Young people should emerge from school being able to read and write, add and subtract, use computers and calculators, understand a map and the history of the country they live in, and have a good grasp of basic scientific processes and a foreign language. Yet, in order to develop young people as creative problem solvers, education can no longer afford to rely so heavily on learning by routine. Education needs to take young people wider, deeper and further, to give them experiences of what it is like to take action, to make things, to serve the community, to work with others and to take on challenges that might once have daunted them.

Learning to be a creative problem solver involves knowing when to follow instructions and when to depart from them. It requires sound basic skills but also the ability to engage in higher-order critical and creative thinking, to find connections and combinations between ideas and concepts to unlock problems.

Problem solving of this kind is rarely just about being smart. It requires persistence to overcome setbacks; a sense of animating purpose to drive you on; collaboration to engage the ideas and insights of other people; empathy to understand the needs of others; the ability to turn ideas into action, to test and improve them. Learning to be a creative problem solver requires a dynamic

combination of cognitive and non-cognitive skills, hard and soft, explicit and tacit, academic knowledge and entrepreneurial ambition.

Schools that achieve that mix are filled with skilled educators who know how to create these dynamic learning experiences. These schools do not fall prey to false dichotomies that divide the head and the hand, theory and action, the personal and the social, digital and real-world learning. On the contrary, they create new combinations of ingredients often thought to be at odds. And, indeed, these schools and teachers are talented problem solvers themselves.

"Assessment should be designed to help students acquire the skills they need to succeed"

All over the world, educators and education systems are taking steps to make education more dynamic. New curricula are being developed to include these capabilities alongside basic skills and content knowledge. Schools are developing more effective methods of teaching and learning, which are rigorous and yet creative. New models of school, often involving project-based and real-world learning, are being created, inside and outside public education systems. These developments are endorsed not just by students and teachers, but also by a growing band of employers, policy-makers and academics.

The area most in need of innovation in order to support dynamic learning, is assessment. But even here, there are a number of potential promising paths forward.

Currently, too many systems demand that students acquire the knowledge that assessment systems mandate. Instead, assessment should be designed to help students acquire the skills they need to succeed. Moving forward, increasingly dynamic assessment systems will involve both formal testing and lots of informal peer-to-peer and self assessments, meaning that students will need to become more used to giving and receiving constructive feedback that will help them learn and improve. This will be one of the most important skills students need beyond school. These systems will also have ceilings that rise and expand as student performance improves; will go beyond testing routine recall of facts to test higher-order thinking, problem solving and creativity; and will deliver

qualitative descriptions and expert judgements of how well a student performs, as well as test results and grades.

What is at stake in the debate over the future of learning is not whether school systems rise or fall in the PISA rankings. It is about how well education prepares young people to flourish in a society awash with intelligent technology, facing an uncertain future, with endless opportunities for collaboration but also deep-seated and urgent challenges that need addressing.

We need to learn to be more human as society becomes more technological, to become more creative as work becomes more programmed, to be more empathetic as systems become more pervasive, to take the initiative rather than meekly follow instructions, to work together rather than go it alone. We are not robots. We must excel at being human.

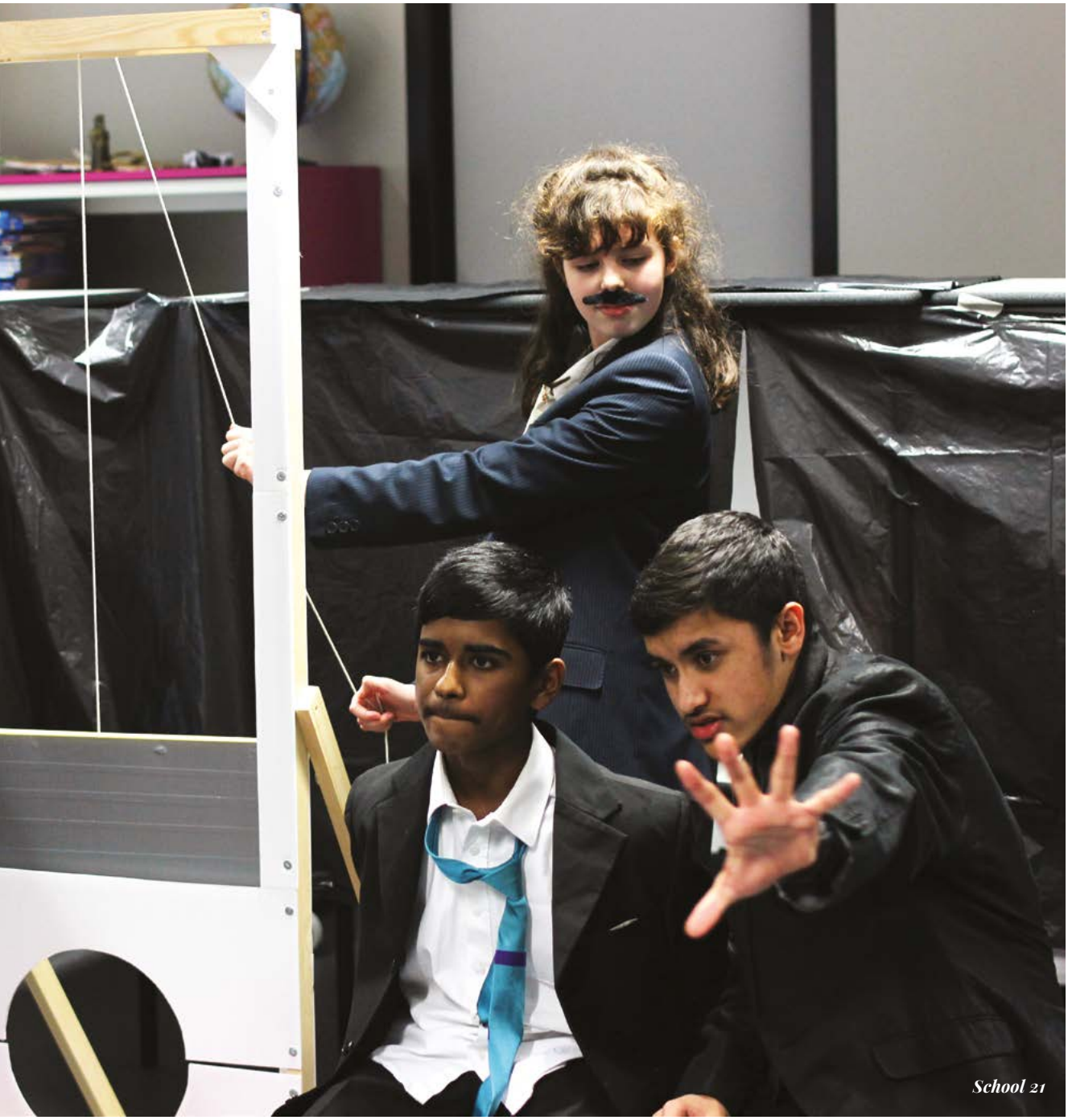
We must facilitate the global learning movement towards more dynamic education systems. In this way we will allow more students to become problem solvers, and to develop the basic human capacities to care, empathise and to create. Those three abilities – to care about what happens in the world, to empathise with other people, and to create new artefacts and solutions – will be more important even than the new knowledge we muster.

Sevenoaks School

Notes

Chapter 1

THE LEARNING DYNAMO



School 21

At first sight it looks and certainly sounds like chaos. About 40 young people are in six groups in a school hall. They are making a riotous noise, some with drums, apparently loosely supervised by three young teachers who seem barely to be in control.

To an observer glancing in, it would not look as if much learning was going on. Yet, on closer examination, it quickly becomes apparent that this could not be further from the truth.

This class at School 21, a non-selective, state-funded school in London's East End is studying history and drama at the same time, as part of their preparation for General Certificate of Secondary Education (GCSE) examinations. Working in groups, they are developing a Brechtian-style drama to explain the rise of totalitarianism. The drama embeds their understanding of the role of propaganda, authoritarianism and coercion in the creation of totalitarian states. Their study of Stalin and Hitler in history lessons informs their drama. Each group spends 20 minutes in turn sitting in a circle on the floor in a corner of the hall, discussing their written work with a young history teacher, before returning to work with one of the two drama teachers. When a teacher wants to bring the room to order he raises his hand and, within seconds, the pupils are completely quiet. In the final 25 minutes of the double period, the class forms an audience that watches and critiques each performance.

There is a lot going on in that room, none of it chaotic and almost all of it designed to deepen students' knowledge by taking an approach that is both highly engaging and intellectually demanding. The drama is made stronger by being based on historical research; the history is made more memorable by its dramatisation. It is a deeper, more engaging and effective way to learn because it is also more dynamic.

The dynamic interactions in the room abound: history and drama; the analytical and the emotional; learning by doing and learning by reading; physical movement and thinking; between the students and the team of teachers, and among the students themselves. Being in that hall is like being inside a small but powerful learning dynamo.

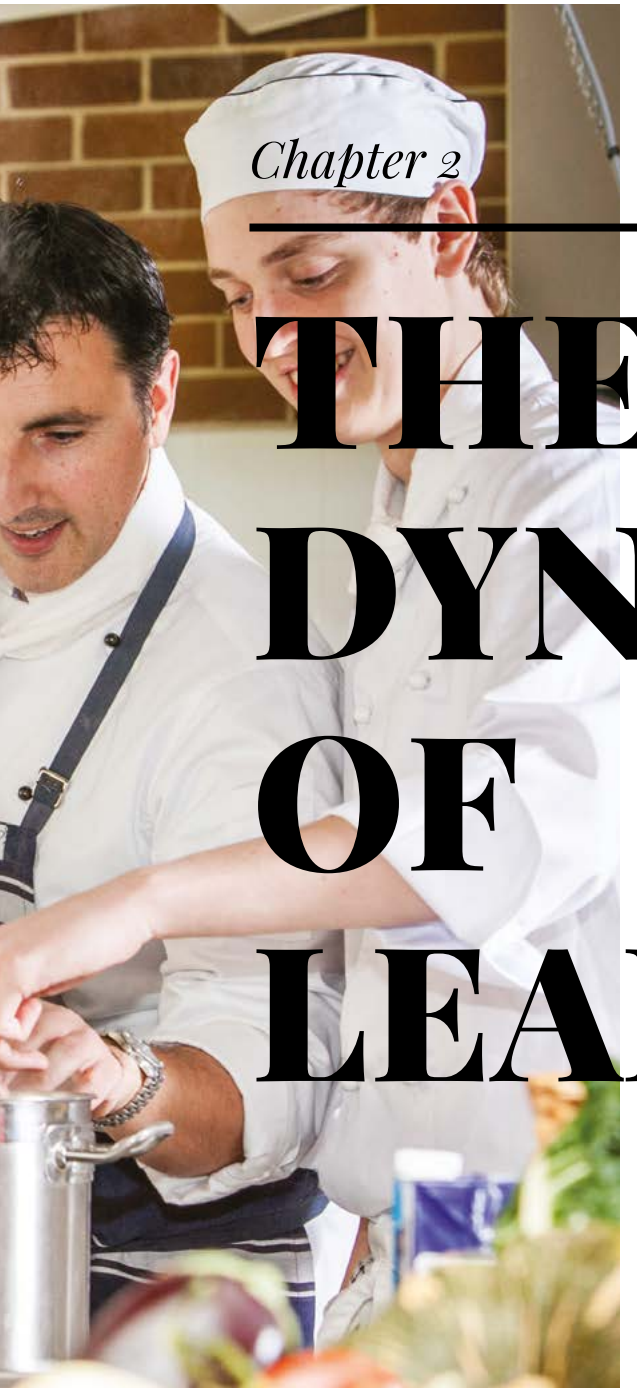
THE PROBLEM SOLVERS: CASE STUDIES Throughout the text, you'll find extended case studies of schools where dynamic learning is taking place. These are meant to be illustrative rather than prescriptive, showcasing the variety of ways that you might prepare people to become better problem solvers. They are also intended to shed light on the fact that this good work is happening around the world, in all different types of schools. To help provide additional context, short profiles on each of the featured schools can be found at the end of this volume.

Around the world, efforts like this are underway to make education a more dynamic, engaging and lasting experience. At Col·legi Montserrat in Barcelona, a group of radically disruptive nuns have devised a way to deliver the Spanish curriculum, and more, through collaborative, interdisciplinary and project-based learning. A similar philosophy permeates the more than 150 schools that are part of the Expeditionary Learning Schools movement in the US: in those schools education is organised around expeditions into the real world. Templestowe College in Melbourne, Australia, has created a dynamic education by ensuring that every child leaves with good exam results and having had a deeply personal experience developing a real-world business. The dynamic education advanced by the Escuela Nueva schools, which have spread from Colombia to much of the rest of Latin America and beyond, equip young people to make decisions together, to be self-governing and cooperative. And in the Trust Schools created by LeapEd in Malaysia, education has become more dynamic through the development of more holistic measures of student success, including creativity, problem solving and resilience.

All the schools profiled in this report are harbingers, early and sometimes faint signals, of what education systems worldwide will need to become to appropriately prepare students for a world that is likely to be increasingly characterised by innovation and entrepreneurship, and which will certainly be more volatile and uncertain. This paper is about why education needs to be a dynamic experience, why education systems themselves need to become more dynamic to deliver that experience and what policy-makers, teachers, students and entrepreneurs can do to make this happen.

Notes

Campbelltown Performing Arts High School



Chapter 2

THE DYNAMICS OF LEARNING

Successful learning is always dynamic. Learning is dynamic when we combine new information we have been introduced to with what we already know, thus creating a new understanding.[1] Good learning draws dynamically from a combination of sources, employing a variety of methods. We all learn from words and pictures, music and movement.

Learning always involves an interaction between different pieces of content (particular information and examples) as the basis for learning more abstract concepts. For example, it is difficult to understand the concept of a capital city, unless you can point to one like Washington DC and understand how it differs from a city that is not a capital like New York. The idea of a capital, also involves learning what a country is and, from the idea of a country, a student can get to borders, exports, immigration and invasion. The route to a deeper understanding of sophisticated concepts always lies through a sound grasp of more basic knowledge.

Learning is dynamic over time as well. It is more effective if it is an iterative activity, which often involves drafting and redrafting work.[2] An imperfect first draft of a solution to a problem often exposes where gaps need to be filled with additional research. Applying knowledge creatively to solve a problem is one of the best ways to embed learning, as it creates a dynamic between learning in theory and in action, explicit and tacit knowledge, in the head and the hand.

Learning also has a social dynamic: it stems from the relationships between students, teachers, coaches and experts that enable the exchange of ideas and information, feedback and reflection.[3] That is why great places to learn feel focussed and active, convivial and yet self-controlled. A good classroom often generates a low buzz of discussion and conversation. These places are systematic and methodical, yet highly empathetic and relational.

The best schools are dynamic places to learn. They provide a dynamic education. At the heart of this is the dynamic teacher, sometimes an instructor,

often a designer, guide coach and facilitator but *always* an activator devising ways to make learning more engaging, demanding and rewarding. Dynamic learning involves both students *and* teachers, doing great work together.

Learning tends to run into the sand for two reasons, both related to a lack of dynamism.

> *"A good classroom often generates a low buzz of discussion and conversation. These places are systematic and methodical, yet highly empathetic and relational"*

When learning is routine mechanistic, or disconnected from life, it becomes dull and boring. Extreme learning by rote is highly ineffective: it makes very little long-term impression on students, rarely teaches them how to apply knowledge creatively, or how to grasp complex concepts. Yet learning can also go wrong when it overloads students with new ideas and information that appear chaotic and confusing. In both cases learning lacks meaning for students and it fails to generate real momentum. Rote learning can seem like the pointless acquisition of information through repetition. Learning becomes chaotic when it stretches students too far with too much unstructured information. The first leaves students bored, the second leaves them feeling lost. Dynamic learning takes place in the vast and productive space between these two. The best schools and teachers are engaged in ongoing balancing acts: they provide a dynamic education.

Discussion questions

1. Based on the information in this section, how would you define dynamic learning?

2. What principles and practices need to be present in order to foster a dynamic learning environment?

    - What is the role of the teacher and what are the roles of the students in achieving and nurturing this type of culture and learning?

3. When you think about your own instructional style, to what extent do you believe you provide your students with a dynamic learning environment?

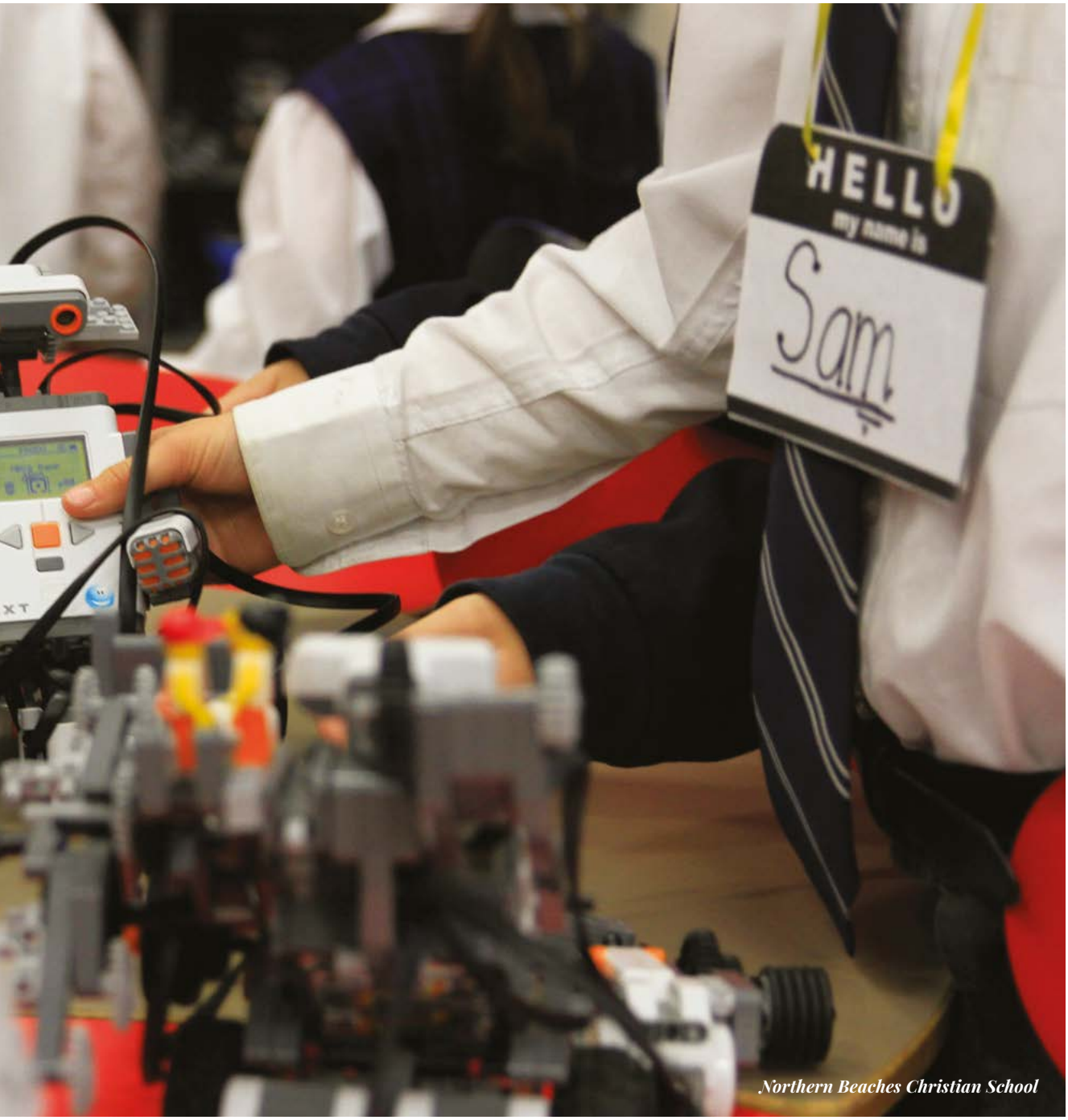
    - Can you share specific examples?

At the end of selected sections, you'll find a list of related discussion questions. These are primarily intended for use by teachers and school leaders, both individually and with colleagues, to prompt fruitful discussions on the ideas and case studies presented throughout. Others, including students, parents, policymakers and influencers, may find them a useful departure point for deeper thought and discussion as well.

Notes

Chapter 3

A TURNING POINT



Northern Beaches Christian School

The big achievement in education over the last two decades is that so many more children are going to school, especially in the developing world.[4] Yet too little of what young people do in school prepares them to tackle the challenges they will face in later life. That is because too many of our education systems fail to equip learners for an uncertain world in which non-routine problem solving will be vital.[5]

Schooling has become a way to instruct young people so that they, in turn, become good at following instructions: to do what is required, in the right way, at the right time. Following instructions is at the core of mass education, and it has served us well in many ways.

Yet in a more volatile, uncertain world, increasingly driven by innovation and entrepreneurship, we now also need to equip young people to find and solve problems of all shapes and sizes. They especially need to be prepared to tackle problems that do not come with instructions.

Young people face a world that is more exponential, fragile, connected and unpredictable. To serve them well, education needs a new sense of its purpose, and a new paradigm for how it is delivered.

At the risk of oversimplification: the core purpose of education needs to shift from learning to follow instructions to learning to solve problems. The reasons are not hard to find.

The jobs that require routine skills and mastery of knowledge that is easy to teach and test, are also the jobs that are easiest to automate and outsource.[6] Better-paid and more fulfilling jobs will require non-routine problem solving, often through face-to-face interaction. To prepare for these jobs, young people need to be open and agile, adaptive and adept at thinking on their feet.

Problem-solving jobs will involve collaboration, often with people who have different skills, possibly from different cultures, in all likelihood in 'flatter' and

more dispersed organisations. Solving complex, non-theoretical problems is rarely just a matter of being clever. It requires patience and persistence because there are no quick fixes. Effective problem solving usually requires people who are reflexive learners, open to feedback, constantly testing out new hypotheses in a highly iterative process, and able to take a step back from what they are learning. Learning how to look at things afresh, to turn problems into opportunities is a key entrepreneurial skill. That capacity will be vital as people are increasingly called upon to create their own jobs, work for themselves and become entrepreneurs.

Moreover, the modern world abounds with problems in need of creative solutions.

The resource-intensive models of industrial production and economic growth that created prosperity in the 20th century will not be sustainable in the century to come. Growing global awareness of the threat of climate change will require the reinvention of many traditional industries and communities that have depended upon them – from energy and water, to transport and mobility.

The impact of technological change is likely to accelerate, not least because new generations of machines are capable of rapid learning and adaptation without human intervention.[7] Young people will need to be critical consumers and creative producers, thoughtful designers and skilful digital makers to ensure technologies are deployed in ways that mitigate rather than exacerbate existing social inequalities.

The relationship between citizens and government is in flux, not least because many governments, facing the demands of an ageing society, will have fewer resources available to spend on other priorities. Citizens are likely to be asked to do more for themselves. Citizens' ability to collaborate with one another to solve problems, especially in cities, will be as important as citizens' relationship to the state.

Nothing about the world that young people face is straightforward, least of all how it changes. To thrive, young people will have to be alert and open, able to contribute alongside others and work outside normal parameters, to fly without autopilot, especially in a crisis. It is a world full of opportunities to make what you will of life, and yet also replete with risk and uncertainty.

Our current education systems work hard at developing basic skills and imparting core academic knowledge – this is critical. Diligent, obedient hard work is typically rewarded, as children learn how to stay "on task" – to focus, isolate, analyse, to do as they are told. Yet they also need to learn how to make

themselves available to the world around them and to worlds beyond their own; to see things as a whole and to make connections between ideas; to find their own tasks to become committed to. Young people will need to judge when it is right to follow instructions and stick to the rules and when to take the initiative with other people without waiting for a manual. They will need to be brave enough to open up interesting questions when there is no obvious right answer and to take action when the outcome is uncertain. That will require persistence and resilience as they try out solutions, fail, adapt fast to feedback and try again, overcoming obstacles and learning from setbacks, as they pivot, twist and turn to find the best way forward.

Too much learning in school locks knowledge in subject silos; creativity and insight often comes from finding connections between those disciplines. For too many students, the point of school is not to excite their imagination, encourage creativity, build self-reliance, form character, learn self-governance, strengthen resilience or develop them as leaders. Instead, children are schooled to put aside what fires them up and to knuckle down to what gets them through.

"Developing persistence, resilience, collaboration and agency is much more like learning to swim than it is like learning the periodic table"

That kind of education will not equip learners for the world they face. All children should enjoy education as a dynamic experience that will equip them to be creative problem solvers. That may sound like a tall order. Yet 200 years ago it would have been regarded as wildly unrealistic to expect everyone to be literate and numerate. How could we make creative problem solving as commonplace as learning multiplication tables, doing a spelling test, brushing your teeth or using a smartphone?

The answer is not to spice up a diet of academic instruction by adding courses in entrepreneurship. Nor is it the addition of critical-thinking modules to a curriculum otherwise designed to prepare students for standardised tests. The shift from "following instructions" to "solving problems" will require a much

more comprehensive change in what and how students learn. That change faces two significant challenges.

The first is that most of the non-cognitive skills now regarded as crucial to success – persistence, collaboration and entrepreneurship – cannot be learned through teacher-led instruction alone. Instead, young people need to be exposed to thoughtfully structured, dynamic experiences through which they can develop these capabilities. No one learns to swim by standing on the side of pool studying a textbook. You have to get into the water, albeit with advice from a coach and lifeguards standing by in case you sink. You have to use your own judgement to move out of your depth, discarding floats when you are ready. Developing persistence, resilience, collaboration and agency is much more like learning to swim than it is like learning the periodic table. Yet few teachers are well trained to provide these experiences and, even if they were, school assessment and accountability systems rarely encourage this kind of activity as part of their core purpose. The skills young people need to succeed will require a different kind of educational experience.

The second challenge is about how students develop the capacity to solve problems. Studies suggest it is often hard to acquire new knowledge while also solving a problem using that knowledge.[8] Solving a tricky problem demands so much cognitive effort that it is usually more effective when people deploy knowledge they have at their fingertips. Finding the right way to build up students' background knowledge while solving a problem takes great skill on the part of teachers. Sitting in class, learning by rote can be a dreary experience. By the same token, taking on a complex problem you lack the skills to solve can be deeply dispiriting.

The innovative teachers and schools profiled in this paper are so interesting and important precisely because they have overcome these two challenges.

They design learning so young people can develop the right combinations of cognitive and non-cognitive, hard and soft skills. They have found a way to develop students' core knowledge while also solving problems that excite and interest them. They have made their schools dynamic places to learn.

Discussion questions

1. Should the core purpose of education shift to problem solving? How might this shift better prepare learners for living and working in the 21st century economy?

2. According to the text, "For too many students the point of school is not to excite their imagination, encourage creativity, build self-reliance, form character, learn self-governance, strengthen resilience or develop them as leaders. Instead, children are schooled to put aside what fires them up and to knuckle down to what gets them through." To what extent do you agree with this statement?

    - How might you think about building character skills while teaching the required core curriculum in your classroom?
    - What are some ways you build in opportunities for students to be creative, build self-reliance, form character, learn self-governance, strengthen resilience or develop as leaders?

3. How could we make creative problem solving as commonplace as learning multiplication tables, doing a spelling test, brushing your teeth or using a smartphone?

    - What are the internal obstacles to achieving this in your classroom or school? Are there existing internal opportunities or strengths that could be leveraged? What resources would you need to successfully make creative problem solving a cornerstone in your students' education?
    - What external barriers would need to be overcome to achieve this at a system level? Are there existing external opportunities or strengths that could be leveraged?

Notes

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Chapter 4

THE POWER OF COMBIN-ATION

Andreas Schleicher, Director for Education and Skills at the Organisation for Economic Co-operation and Development and the architect of the hugely influential Programme for International Student Assessment (PISA), which ranks education systems' performance now argues that: "The world no longer rewards people for what they know – Google knows everything – but for what they can do with what they know. Because that is the main differentiator today, global education today needs to be much more about ways of thinking, involving creativity, critical thinking, problem-solving and decision-making; about ways of working, including communication and collaboration."[9]

Schleicher and his colleague Qian Tang, Assistant Director-General for Education at UNESCO, frame the goal for education this way in their introduction to a report on the importance of basic skills: "Ensuring that all people have a solid foundation of knowledge and skills must be the central aim of the post-2015 education agenda. This is not primarily about providing more people with more years of schooling; in fact, that is only the first step. It is most critically about making sure that individuals acquire a solid foundation of knowledge in key disciplines, that they develop creative, critical thinking and collaborative skills, and that they build the character attributes such as mindfulness, curiosity, courage and resilience."[10]

All over the world, academics and think tanks, commissions of inquiry and foundations, schools and teachers have issued similar calls to action. They have proposed ways to create combinations of capabilities and competencies that include creativity, confidence, collaboration, communication, critical thinking and character. Yet, thus far, these diverse efforts lack a coherent organising framework to make them mainstream.

Schleicher puts the challenge this way: "The foundational reason for why we find it so difficult to rebuild school curricula around the needs of the modern world is that we lack an organizing framework that can help prioritise education competencies and systematically structure the conversation around what individuals should learn at various stages of their development."[11]

Yet within education, an underlying consensus is building: young people should be equipped with a combination of knowledge, personal strengths, social skills and a capacity for agency. Or to put it more succinctly, they should go to school to acquire knowledge to grow, collaborate and act.

Each of these elements can be thought of as a journey that education should take young people on:

- A journey into knowledge, starting with the basic skills of literacy and numeracy, moving on to knowledge of core content and then to higher-order concepts and thinking skills, to challenge, question and adapt existing knowledge.

- A personal journey to develop their strengths and character, including their sense of purpose, ambition, resilience and persistence.

- A social journey to deepen their relationships with other people, to learn how to connect, communicate and collaborate, to achieve things together.

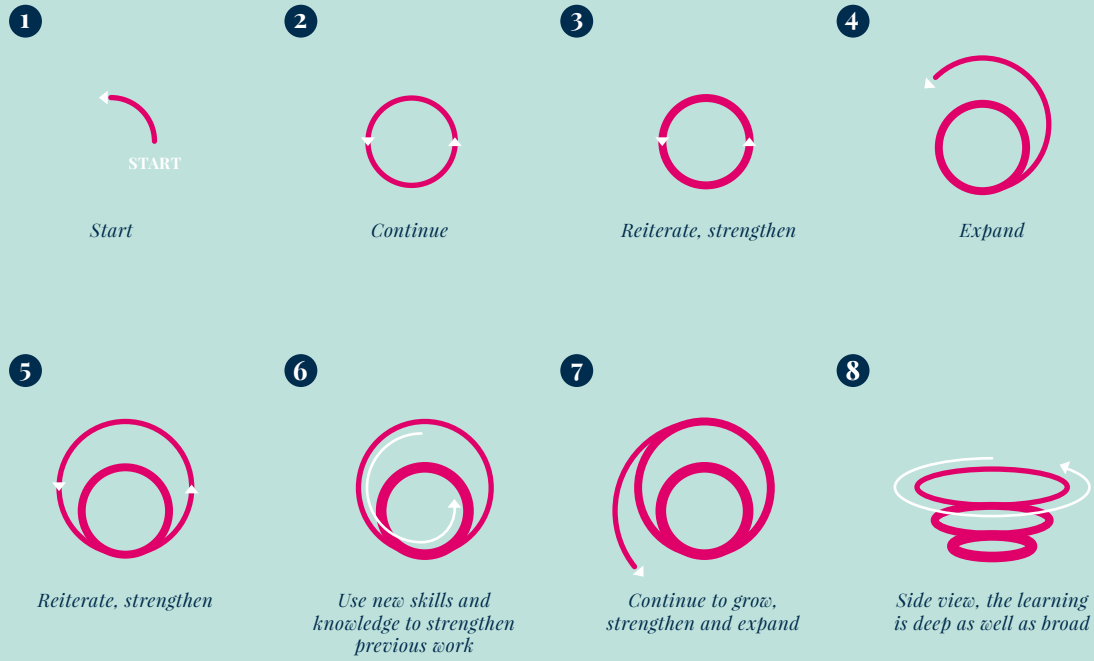
- A route to take action, to make a contribution by helping other people and so make a difference to the world.

Each of these four elements matters in their own right. Yet it is their dynamic combination that brings them to life. They become really powerful when young people learn to develop and deploy them together. Good schools and skilled teachers know how to create a dynamic mix of these ingredients,

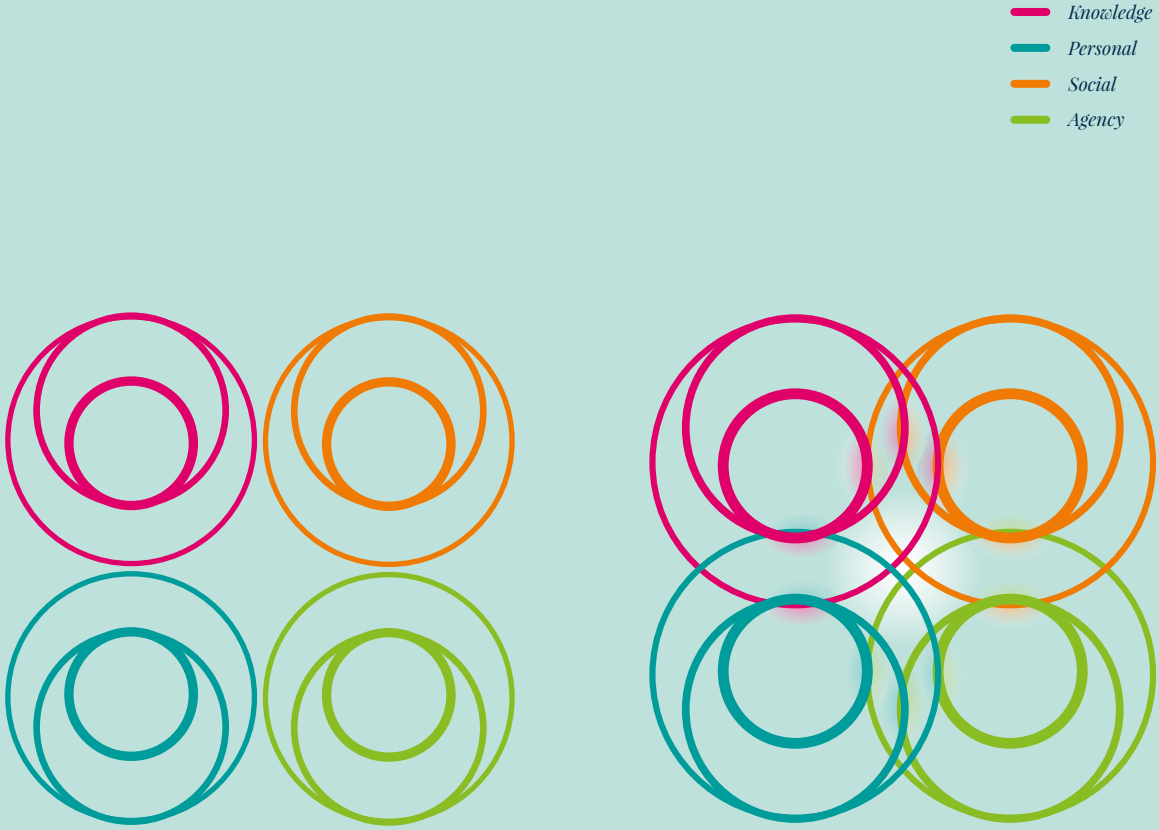
to move students between these different aspects of learning: sometimes focussing on building up core knowledge, at other times encouraging people to learn by making and doing; sometimes developing personal strengths, at other times focussing on how people collaborate and work together; and often doing more than one of these things at the same time. Young people should emerge from school being able to read and write, to add and subtract, to use computers and calculators, to understand a map and the history of the country they live in, to have a good grasp of basic scientific processes and a foreign language. Yet if education is to develop young people as creative problem solvers, it can no longer focus so heavily on learning by routine. It needs to take young people wider, deeper and further, to give them experiences of what it is like to take action, to make things, to serve the community, to work with others and to take on challenges that might once have daunted them.

Let's take each of the four key elements of dynamic learning in turn and explore their interconnections.

Dynamic Learning



Learning begins by building a foundation of knowledge and skills – for example, a form of literacy. This foundation is strengthened as the learning continues and students become capable of expanding their range, putting knowledge to new uses. As they become more adept at developing their knowledge so the foundations of their knowledge need to be stronger.



Students build up their knowledge, skills and capabilities in each of the four domains displayed in the image above on the left, but rarely does this happen in isolation. Learning becomes more powerful when it becomes more dynamic. This happens when the elements overlap, when learning becomes a social, dialogic and collaborative activity; when knowledge is tested and put to use in the cause of making something; when learning becomes a personal journey requiring resilience and determination. Great places to learn are places where these four aspects of learning overlap, interact and gain momentum from one another.

Discussion questions

1. Could you take these four circles and arrange them to represent:
    - How learning takes place in your classroom?
    - How learning takes place during a particular activity/lesson?
    - How your school believes learning should happen?

2. Is there an element that's missing from this set of four? What ingredient would you add if you had a fifth 'blank' circle that you could use to represent anything?

Notes

4.1 Knowledge

Learning is the acquisition and assimilation of new knowledge, through an iterative and cumulative process, which requires patience, effort and energy, as new knowledge is integrated with old.[12] What you know to start with is one of the most important determinants of what you can go on to learn. The gap between what you already know and the knowledge you are trying to acquire, which can be unfamiliar and challenging, frequently creates a fear of failure. Our working memory can often become overwhelmed when dealing with novel, apparently disorganised and unrelated information. Finding new patterns, rules and regularities to make the new information meaningful is an effort. Good teachers excel at traversing students across this gap, structuring learning so it is motivating and stretching, not overwhelming and confusing or repetitive and dull.

An outstanding example of how to help students build up knowledge in a structured yet personalised way is the Kunskapsskolan school methodology which has spread from Sweden to schools in the UK, the US, the Netherlands and India. The Kunskapsskolan approach to learning is both personalised and systematic because it makes sure the basic building blocks of learning are in place before students move on.

Kunskapsskolan breaks down what a student needs to learn to master a school subject into about 40 modules, which in turn are grouped into eight clusters. In each cluster there are four formative modules and then a fifth summative module, which tests their knowledge. To move on to the next cluster, the student has to pass this summative step. If they do not meet that standard,

they go back to reinforce their knowledge before resitting the fifth module. Rather like levels in a computer game, this creates a rigorous system for student progress but also allows students to go at their own pace: some students move through modules very fast, others take much longer. In Kunskapsskolan schools, students are grouped by ability and attainment rather than age. They can pace their learning as they and their teachers feel appropriate. More able students can move through the modules fast and so not risk getting bored. Students who need more time can do so without feeling they are falling behind the rest of the class.

This highly personalised approach to learning is combined with collaborative, project-based learning, which follows a cycle of research, analysis, presentation and review. That cycle provides an underlying structure and yet allows freedom for experimentation. Each project ends with a student presentation and a challenge to the students to apply their knowledge in a new context: a group that has been studying Europe's medieval history might then apply that knowledge to a part of the modern world to see how it compares.

John Baumber, a former Kunskapsskolan school principal and now Director of Education for the group's operations in the UK explained: "We want to set some very clear criteria for what children need to learn, so that if their overall goal is to, say, get an A in English, they know what that means for what they do today, whether in terms of the modules they are doing or a project they are involved with. And they have to talk through their goals and really take responsibility for them, so there is no drift."

There is growing consensus that the kind of knowledge education builds up should be a dynamic mix of sound, basic skills, crucial core knowledge and higher-order thinking.

Sound basics, especially literacy and numeracy, as well as basic cognitive processes, like executive function which affects memory, are essential building blocks for learning.

Young people should also acquire core knowledge, in history and literature, science and mathematics, to help ground them in a sense of who they are, where they come from, what kind of society they are part of and the wider world they inhabit and engage with.

What really matters, however, is whether this then enables students to take on more complex, higher-order cognitive tasks involved in creativity and problem solving.

To be adept at problem solving, students need to be able to swiftly recall and deploy basic building blocks of knowledge without having to learn them in the midst of the process. Moreover, knowledge of content goes along with the capability to put it to creative use. John Hattie and Gregory Yates put it this way: "You must have something to think about before you can relate, extend, critique and enquire. Enquiry and critical thinking needs to be embedded in content knowledge of a subject domain."[13]

It is not just that deeper thinking needs to build on more basic knowledge of content. Creative problem solving turns on being able to make more imaginative links between different aspects of knowledge, in at least three ways:

1. Deeper learning of strings, schemata, concepts and principles, so that the same idea – division, navigation, democracy, energy, growth, revolution – can be applied in different contexts across the curriculum as well as to problems in the real world.

2. Schools break down knowledge into discrete subjects. Many of the challenges of the outside world require combinations of knowledge from several disciplines. Interdisciplinary learning helps students to see how to make connections between knowledge that might otherwise remain trapped in silos. Interdisciplinary approaches to learning are only possible when knowledge in each discipline is developed in a structured way. There are no short cuts. A good example is the Te Kura Kaupapa Māori o Te Koutu, a composite school in New Zealand, set up in 1993, which gets excellent results in government tests but also aims to deepen students' understanding of their identity, culture and language. Everything at the school is taught within that cultural context, which is possible only because so much learning is interdisciplinary. A study of the genealogy and genetics of local tribes, for example, simultaneously engages biology, geography, history and language, as well as the digital skills to explore various family history databases.

3. Being able to question claims to knowledge, to see what they are based on, is more important than ever in a society awash with information. The fact that search engines can find any piece of information does not relieve us of the responsibility to test whether it can be trusted. More readily accessible information requires more discerning critical thinkers to sift what can be discarded from what really matters.

Learning is often hard work. As students progress through these aspects of knowledge they require persistence and resilience. All learning involves a student making a personal investment and aspects of personal growth. That is why learning is so personalised in schools like Kunskapsskolan. As learners become more skilled and proficient, they can also become more creative, learning how to test, adapt and manipulate knowledge. They should enjoy a growing sense of agency, that they can make and do something with their knowledge.

A good example of how all these aspects of acquiring knowledge can be brought together is the International Baccalaureate Diploma Programme (IB) which includes studying a mix of academic subjects, combined with an extended essay, to encourage in-depth independent research; a theory of knowledge module, to encourage students to inquire into the nature of knowledge; and a creativity, action and service module, which encourages physical activity, the arts and work in the service of the community, to develop personal and social strengths. The characteristics that the IB encourages include a mix of skills: inquiring, knowing, thinking, as well as being communicative, open, caring, reflective and risk taking.

At Sevenoaks School in Kent, one of the UK's top academic schools, Tim Jones, the Academic Deputy Head, is embedding the theory of knowledge much earlier in the school. In Years 7–9 pupils study self and religion in Systems of Belief; in Year 10 Critical Perspectives, to explore how the news is covered; and in Year 11 they take on 10 Ideas that Changed the World, ranging from God to the Internet. "We want to develop from early on a more thoughtful, critical attitude towards knowledge," Jones explains. Sevenoaks recently cut significantly the amount of homework it sets students to reduce the pressure they are under and it has introduced its own exams – Sevenoaks School Certificates – in subjects such as music, English literature, and technology and robots, where it believes GCSEs and the International GCSEs (or IGCSEs) do not adequately stretch and challenge pupils, nor give them opportunities to think and question deeply. Jones says: "Of course we want our students to get good results and get into good universities, but we also want them to have a broader perspective on life and what matters."

The innovators profiled in this paper believe knowledge should be at the heart of learning. Indeed many underpin that with insights from neuroscience. At each stage of a student's development they seek to make sure the basic building blocks of knowledge are solidly in place before moving students on to more

complex, sophisticated and demanding tasks that draw in basic knowledge and skills in new ways.

Yet, like Tim Jones, they recognise that, although knowledge is vital, it is not enough to equip young people to shape the world. What matters is what you do with what you know, with other people, and to learn by turning ideas into action. That is why the acquisition of knowledge needs to be combined with the development of other skills and why learning needs to be a dynamic activity.

4.2 Personal Growth

Learning should be a personal journey of growth and discovery. Yet when the staff at Shireland Collegiate Academy reviewed first-year experiences with students, they heard stories of failure and disappointment. Many told teachers they felt the school was impersonal, as if no one knew or cared who they were. "It was pretty horrendous," recalls Sir Mark Grundy, the school's Principal. "We decided then that we had to change things." What eventually emerged from that traumatic session in 2006 was what Grundy refers to as the school's "odd curriculum" which he calls "literacy for life."

Grundy and his team did not attempt to create a new curriculum from scratch but sensibly started by borrowing from existing programmes they thought offered promising models. An initial experiment with a curriculum organised around creativity made them realise they needed what he calls a "harder edge", which would do more to build basic skills of literacy and numeracy.

Eventually they came across an approach developed for fishing families in Anchorage, Alaska. The families were constantly moving to follow the fish. Children often had to switch schools. So they had to carry with them a record of what they had achieved, where they were strong, where they needed help and what their goals were.

Grundy's team took that model and applied it to multi-ethnic, industrial Smethwick in the English Midlands by turning it into a list of 10 core competencies that children should aim to master while at the school. These range from communication and numeracy, to leadership, resilience and collaboration. It is learning as a personal experience because it develops students more fully as people, as Grundy puts it, to make their way in the world.

The starting point is a carefully graduated transition from primary to secondary to build up students' confidence. In Year 7, the entry year, students spend 19 hours a week with the same teacher, much as they would in primary school. The amount of time they spend with a single teacher then goes down to nine hours in Year 9. Throughout these first three years, staff work with students to track the development of their social and personal competencies, as well as their basic skills.

"Learning has to be personal: there is no neat boundary between the cognitive, social and emotional aspects of learning. They constantly interact"

At this stage most learning is done through collaborative, thematic projects with names like iRobot, Little Big Planet and The Day of the Old. Thematic teaching makes it easier to combine the development of cognitive skills – especially literacy and numeracy – alongside creativity and collaboration, technological and scientific literacy. Each child has an online tracker that records their progress in each competence over four levels each year. One of the advantages of this rigorous focus on personal development is that students can incorporate achievements from outside school – from clubs and hobbies –

which contribute to their school record and create a much fuller account of how a young person is developing.

There's a sting in the tail as well. To get to the highest level in any competency – mastery – a student has to help someone else make progress in its acquisition. This has multiple benefits. One of the best ways to embed what you know is to help someone else learn it. Teachers in mixed-ability classes can call on those at the mastery level to help their peers who are making slower progress. Grundy says this makes the teaching of large mixed-ability classes much easier.

The result is that, by developing personal strengths, Shireland helps students develop their cognitive capacities as well. They learn and know more because they grow more as people. As Ofsted reported in 2010: "Nowhere is accelerated progress more evident than in Years 7 and 8 where the excellent competency-based curriculum has had a remarkable impact on the standard of students' work in English and mathematics, as well as their wider personal development."[14] This is win-win learning. As a student's capacity for resilience grows, so does their ability to overcome obstacles and setbacks and so does their ability to learn and acquire new knowledge. That gives students more confidence to take on further challenges which require resilience and persistence.

Learning has to be personal: there is no neat boundary between the cognitive, social and emotional aspects of learning. They constantly interact. All learning requires personal strengths of persistence, effort and focus to overcome fears, self-doubt and obstacles.

Education should help young people develop personal attributes of character that will count in later life. Their capacity for grit, resilience, persistence, growth and curiosity, will be at least as important to their success as their ability to recall the answers to tests in history or chemistry they sat when they were 16. In the modern, shifting world of technical, social and organisational change, young people will need not only to be resilient and adaptive, they will also need to have a clear sense of purpose, to know the difference they want to make, the value they want to add. That is part of what they learn at School 21.

A bright-eyed 8-year-old called Liam, is focussed, as is everyone in his class, on making a board game they have each designed to explain why a volcano erupts. The version that Liam is working on is his third draft of a game that has changed considerably from his first effort. When asked to describe what the second version of his game was like, Liam sighs and shrugs: "Oh that was complete rubbish. This is much better."

That culture of self-criticism and self-improvement runs throughout School 21. Too often, according to Peter Hyman, the Head Teacher, young people are told that school matters because it will help them in future: if they get good results, they will get into a better university and eventually find a better job. For many young people that promise of future benefits is too abstract and distant to make school compelling; they need something more immediate. The answer, says Hyman, is not gimmicks to make learning more superficially fun or contemporary, but to see school as a place you go to make great work, which is rewarding in itself and provides a sense of personal achievement.

The lesson that School 21 tries to teach is that good work requires openness to feedback and persistence: you have to stick at it. One of the first tasks set for children when they arrive in reception, for example, is to do a portrait of themselves as a Tudor King or Queen, to see themselves as Henry VIII or Anne Boleyn. The first paintings the children come up with generally involve large, fairly formless blotches of fleshy colour, with a face and some hair. What happens then is that the children, working in groups, helped by their teacher, work out how their first effort might be improved. In the second draft of the painting, a nose might appear, eyes get colour, lips turn red. Then they repeat the process, adding clothes, eyebrows and the ears. The final, fourth draft is, without exception and quite visibly, a massive improvement on the first: the paintings often look more akin to classic paintings of Henry VIII or Anne Boleyn. The paintings look as if they were painted by children several years older: the facial features are crisp and detailed; the clothes are colourful and decorated; the background is carefully composed.

What children learn is that making work that you are proud of involves learning from feedback, acquiring new skills, and above all, sticking at it, not giving up when the first try is a tad disappointing. That ethos of learning through making great work creates a powerful culture of collaborative self-improvement which runs throughout the school.

These approaches are informed by mounting academic research on the important dynamic between learning, persistence and personal growth.

- The more that young people believe that their intelligence can grow and develop, the more likely they are to learn. That is the kernel of Carol Dweck's highly influential work, which has found that people learn most effectively when they have a "growth mindset".[15] Individuals with a growth mindset are more open to questions, unafraid of the unknown and willing to take

on challenges even when there is no guarantee of success. Dweck contrasts this with a "fixed" mindset, which tends to inhibit learners from exploring outside their comfort zone. People with a growth mindset are far more likely to cope well in uncertain, ambiguous environments where they have to improvise and assemble untested solutions, than those with a fixed mindset who work best within a set of rules and order. Logically, as the world becomes more complex, and learning is increasingly focussed on problem solving, these personal capacities also become more important.

- It is not just learning that requires persistence, but all forms of innovation, entrepreneurship and problem solving. Angela Duckworth's increasingly well-known research suggests that the successful innovators and entrepreneurs are the ones who stick at their idea, improving and adapting it even when they faced setbacks and failures.[16] Young people entering a fluid, entrepreneurial economy should leave school ready to try and try again, armed with experiences of how to "fail forward" and to learn from their mistakes.

- Passion and purpose can propel us to learn; they can also provide us with a sense of perspective to cut through the fog of confusing information and distracting possibilities of the digital world to find what matters to us. Schools encourage young people to explore who they are, what they stand for, what matters to them and who they want to be.[17] That is difficult if the point of school is to follow instructions.

These personal qualities – growth, persistence and purpose – cannot be developed through traditional instruction alone. Telling children what it means to be persistent, and even giving them inspiring examples, is not the same as providing them with powerful, lasting experiences where they learn the importance of those qualities for themselves. Teaching resilience only makes sense if children experience and develop it for themselves.

It is also worth remembering that, for some children, just getting to school and sticking with it requires persistence. That is true for many of the children who attend the Broome Street Academy in downtown Manhattan, a community charter school that mainly serves students who are in homeless or foster care and who have come from schools near the bottom of the league tables. Many come to school dealing with deep traumas created by violent and abusive adults in their

lives. According to Barbara McKeon, the Head of School, they have neither much social capital nor much self-belief. When McKeon arrived at the Academy in 2013 many students used violence themselves as the best way to solve a problem. Fights in the streets around the school were commonplace. Attendance was poor. Expectations were low and student performance followed in lockstep.

"Personal growth and learning are only possible in a social context, which is why dynamic learning has to be a collaborative enterprise"

After working intensively with her most disruptive students, McKeon created a simple yet highly effective pastoral system so each student has a mentor, called a Champion, to support them, set high expectations and instil strong self-discipline. The relationship between student and Champion is designed to be informal and yet intense; the Champion is someone to turn to for help but who will also be on your case to get your work done. One sign of the system's success is that attendance has risen from 68% to close to 87%. McKeon explained: "Many of these kids are coming back to school, despite the fact that they have failed repeatedly in the past. That takes real persistence. We've only been able to do that because we have won their trust. If there is no trust, there is no risk taking and learning involves taking a risk, the risk that you will not be able to do it first time around." Problem solving is one of the most important skills the Academy teaches she says: being able to solve a problem through a discussion rather than a fight.

Finding out who you are, what you stand for, what makes you different, is not just an inner journey. We find out who we are in the context of the relationships that form us, by how we collaborate with and distinguish ourselves from other people. Personal growth and learning are only possible in a social context, which is why dynamic learning has to be a collaborative enterprise.

4.3 Social Skills

Sister Monika Horch sits in an attic room cluttered with teaching materials at the Col·legi Montserrat in Barcelona and tries to convey what she and her colleagues have learned from their "20-year transformation." Over that time the Col·legi has learned from far and wide, embracing Howard Gardner's theories of multiple intelligence, Roger and David Johnson's approaches to collaborative learning, IDEOs design thinking and the project-based learning developed by Larry Rosenstock at High Tech High. Yet at root their approach, she says, is very simple.

"For us knowledge and learning starts when children find a need to learn. Once they can see that they need knowledge to do something that matters, especially if it makes a difference to someone else, then they want to learn. So the key to learning is to find a problem, a need or a question which children feel motivated by which will lead them to learn. We do not try to explain things to the children and then get them to do things with their knowledge. We find interesting questions, challenges that they want to research and do something about, so they pull the knowledge to them."

From that simple insight Col·legi Montserrat, a school run by a group of disruptive, innovator nuns, has developed an approach to learning that is pitch perfect for the times. The Col·legi operates within Spain's national curriculum. Students do well in their final exams, including the International Baccalaureate. Yet the way the Col·legi gets those results is quite different from a standard school. That difference helps to prepare students for the wider world more effectively than many schools. This is how the nuns work their magic.

Before the start of each academic year, the nuns and the teaching staff work out how they will meet the goals of the national curriculum almost entirely through project-based learning, in which teams of teachers work with groups of children to address a problem. "It might be a problem in the real world or it might be something that matters to them just in their social group," explains Sister Monika. "The key is that the problem has to be real for them, it has to matter. At the moment, for example, we are looking a lot at problems facing refugees. And if you want to design a cheap house for refugees then you need science, economics, geography, language, technology. We teach English and maths on their own and we do one project per term for those subjects. But most other subjects we do through eight or nine projects a year, and we teach subjects together so children learn in a structured way, history alongside geography, art with science. The projects involve real-world research, seminars with experts, experiments under controlled conditions and of course, when it's appropriate, instruction and traditional teaching. At the end of the project, students have to produce something that they can show to other people: an exhibition, a video, a book, a seminar. They learn a lot through the process of making these things together."

This is a highly collaborative process, in which children have to take responsibility for their own learning. Sister Monika explains: "We have some simple rubrics for building up their capacity for collaboration. We want to encourage them to see they are interdependent, so they have to learn to stay together, to respect one another, to ask questions and to support one another. These are vital interpersonal skills."

Students leave Col·legi Montserrat with good exam results but also as confident people capable of taking the initiative: "Our goal is not to get them to think about what job they will get," says Sister Monika. "We want to empower them to think: 'How can I start doing something through work which makes the world a better place?'"

Acquiring new knowledge is invariably a collaborative affair: it involves dialogue and discussion to understand and explore both the question and its possible answers. Giving and taking feedback, from peers, students and teachers is critical to how people learn to improve their work. Learning how to get on with other people is one of the most important unwritten lessons of school. In a problem-solving economy, however, schools needs to go beyond this to develop deeper and more sophisticated social and emotional capacities.

When many basic tasks, like booking a plane ticket, scanning a barcode, or adjusting a thermostat, can be done by artificially intelligent machines,

human work will focus on face-to-face, service work, which cannot be outsourced or automated. We need to excel at being human. These personal services will require people who are empathetic and caring, emotionally intelligent and responsive. Schools that focus on drilling children to follow instructions will not fully develop these social and emotional skills which many employers now regard as essential.

Good work will also involve solving problems for people, often quite tricky ones. Yet solving a complex problem – such as how to build a low-cost house for refugee families who do not speak Spanish – usually imposes a heavy cognitive burden on an individual. That burden can be made manageable through collaboration. The problems are broken down, the tasks shared out, the solutions assembled from contributions from many people.

This why real world innovation and problem solving is an inherently collaborative activity, often stretching across national boundaries and cultures. When problems are complex, solutions invariably emerge by combining different insights and points of view. Groups with diverse skills and outlooks come up with smart solutions more often than groups of very clever people who share the same outlook and knowledge.

Instead of encouraging all students to come up with the same answers, which is how most exam systems work, we need to encourage them to see that there might be different answers, or at least different components to an answer, that need to be brought together. Diverse viewpoints are likely to generate more possible solutions and evaluate those solutions from a wider range of vantage points, so spotting potential flaws. Getting people with diverse viewpoints to collaborate can be tricky. That is why the skills of collaboration, to learn how to work creatively with other people, are so vital. Turning a creative idea into something real – making a film, play, game, object or service – requires yet more skills to be brought into the mix.

The skills of collaboration can be modelled and emulated, but they cannot be taught solely by a teacher at a blackboard or a textbook on the desk. New ideas breed and cross-fertilise in active, curious, outward-looking communities: that is what creative companies are like and it is what great schools should feel like. Schools should be formative, uplifting experiences for young people of what it is like to be a part of a creative community, with the skills and habits of collaboration at its heart. In the real world, these places – whether they are companies, sports teams, creative organisations – feel like dynamic places to learn.

Collaboration will also be ever more important to modern citizenship. Cultivating citizenship, an identification with a shared national history and institutions, has been a central goal for mass education systems created in the midst of industrialisation, urbanisation and migration. Yet, in the modern world and especially in cities, people increasingly self-organise and connect through digital platforms. Much of the time the citizens, in effect, rule one another, together, peer-to-peer. Young people all over the world are increasingly adept at harnessing the new power of peer-to-peer, do-it-together citizenship. Thomas Jefferson said that education should be an experience in self-governance, taking responsibility for one another and making decisions together. That is even more true today and a prime example is the spread of Escuela Nueva's methodology for collaborative, self-organised learning across Latin America and beyond.

Marina Castro cheerfully admits that she did not have a clue what she was doing when she started her career as a teacher in a small rural school in Colombia. She was on her own, trying to teach about 50 children of all ages. It was not the idyllic world of the single-room schoolhouse of *Little House on the Prairie:* "Nothing had prepared me for it. I had no tools to handle a multi-grade school. After a couple of weeks I was on the verge of giving up." Then a colleague introduced her to a three-week training course in a method designed to help teachers. Escuela Nueva is a way for teachers to organise pupils into groups for self-organised learning using step-by-step learning guides. When these guides were taken to Africa, they became known as "silent teachers".

Colombia has been pursuing universal primary education since the 1950s. By 1994 eight out of 10 children were enrolled but, in reality, access was highly unequal: 89% of city children were in school, but only 66% of those in rural areas. Eight out of 10 rural primary-age children were in multi-grade schools like Marina Castro's. If all students are not fully occupied then their time on task falls, their achievement drops and they can quickly get bored: discipline degenerates, the teacher feels they are losing control and they become frustrated and feel overworked. Not surprisingly, multi-grade schools with traditional teaching methods deliver poor results: in the 1980s only 59% of Grade 1 students in these primary schools progressed to Grade 2, compared with 74% in urban schools.

Vicky Colbert the founder of Escuela Nueva came at the problem of multi-grade schools from an unusual angle. She had been educated at the American School in Bogotá and then Stanford University, in California. When she returned to Colombia to work in the Ministry of Education, she chose not to work

in the heart of the system nor in a rich urban school, but at the margins, with the poorest, worst performing multi-grade schools because they were most in need of innovation. Colbert worked with rural educators who were already putting into practice ideas for collaborative learning to create a more systematic approach. The method is almost Socratic, posing children questions and challenging them to justify their answers. If several groups can be encouraged to learn this way then the teacher can devote more time to other children who need more help.

That is not the only benefit. In a traditional school, children who miss a term, for example to work on the family farm, would have to repeat an entire year. In an Escuela Nueva, children are able to learn at their own pace, dipping in and out of school, as their family's economic circumstances demand. Repetition and dropout rates are reduced. Escuela Nueva schools are more likely to engage local communities, and that means they are twice as likely as a public school to have a library.[18]

"The danger in education is that responses to failure tend to be administrative. Changing how systems work, centralising or decentralising, new reporting systems," Colbert says. "The key is to change how learning takes place which means new approaches to pedagogy. The teacher has to become a facilitator, to motivate the children to learn rather than transmit knowledge to them."

Escuela Nueva, working in the very poorest schools, has created a model of dynamic education that is participative, collaborative and flexible. In an Escuela Nueva, school children should be sitting in circles, in discussion, figuring out how best to work through the tasks set by the learning guide. Colbert says the children are learning not just maths and Spanish but the skills of negotiation and compromise, to be self-governing citizens.

Escuela Nueva started in 1975 in 150 tiny rural schools. By 2011 it was operating in almost 17,000 Colombian schools and had been taken up in 19 countries, including Guatemala and Brazil. Escuela Nueva, out of a mixture of necessity and idealism, is encouraging what many would describe as the most contemporary of 21st century skills: collaborative problem solving and creativity.

It does not take long to train a teacher in the Escuela Nueva model: they have three weeks of training spread across a year, followed up by regular bouts of in-service training. When that training is done well, it can have a lasting impact, as Marina Castro explained: "The beauty of this approach is that the teacher does not have to know everything to be able to teach the children. In Escuela Nueva, the teacher facilitates more and can focus more on their relationships with

children rather than pushing information at them. It's a more horizontal, less vertical relationship. The children become more autonomous, develop their own talents and learn how to express themselves, to become protagonists."

That idea of students as protagonists brings us to the fourth element of dynamic learning: agency, the capacity to turn ideas into action.

4.4 Agency

To prepare students for a modern economy, schools will need to be places where students have a sense of agency and responsibility, learning how and when to take the initiative, when to wait for instructions, when to act and how to turn an idea into something tangible.

Learning and doing are intimately connected. It is a well-worn adage, but nonetheless true: we learn by doing. A good test of whether a student really understands what they have learned is whether they can apply that knowledge in novel situations, away from the controlled environment of the classroom. Quite a lot of useful skills – learning to scuba dive or to bake bread – can only come from doing the activity, in practice.

Learning how to apply what you know in practice is part of what makes learning dynamic and that is at the heart of what they are doing at Templestowe College in Melbourne.

It's fair to say that Josh is in his element. An unruly mop of curly hair, rosy cheeks and boundless enthusiasm, Josh is looking after a room full of snakes (in tanks), some of them quite large. He could not be happier.

Josh, is just 15 but he already knows that when he leaves school he wants to launch a business that works with animals. So it's handy that he is at a school – Templestowe College on the outskirts of Melbourne – that is giving him ample opportunity to become an entrepreneur. Templestowe is a school and a start-up community all rolled into one.

"Learning and doing are intimately connected. It is a well-worn adage, but nonetheless true: we learn by doing"

Josh's first foray into business was to resell the school's old student lockers. The $2,500 he raised through that sale was reinvested in Templestowe's animal sanctuary. Now Josh has just secured a loan from the school's business seed fund to create his own business, taking the snakes and other animals to local primary schools. To do that, Josh has become an employer: he needs to be accompanied by a biology teacher from a supply agency. His aim is to charge the primary schools a modest fee so he can repay the loan.

When Josh leaves school he should have achieved respectable grades in his leaving exam – the Australian Higher School Certificate (HSC) – but in addition he will have a track record in running a real business with products and services, customers and income.

Peter Hutton, Templestowe's Principal explained the rationale: "We want all young people here to have a good shot at going to university or, if not, then to a technical college of their choice, but also to have in their back pocket a business that they have created which could be the basis for what they work on in future."

All over Templestowe – built as a technical school in the 1970s – pupils are working for a living as a part of everyday school life. Jess in Year 10, for example, set up the Friday lunchtime coffee club, for which she got fellow pupils trained as baristas. She now spends several hours a week providing reading support in the primary school next door. Her ambition is to be a speech and learning therapist.

Owen, in Year 11, is part of the educational consultancy the school has set up to make its methods available to other schools. Students who have a good "work study habits" score are offered jobs as personal tutors in the spacious Resource Centre which is the heart of the school, a cross between a café and a library.

Entrepreneurship is not an add-on at Templestowe. It stems from the school's philosophy that students are agents in learning. That is why learning at Templestowe is highly personalised: students can create their own study programme from any of 150 options; choose which of three start times for their school day; and work with other learners at the same stage of a course regardless of their age. The quid pro quo is that they are also expected to make a personal commitment to their learning.

4.5 Dynamic Learning

Learning to be a creative problem solver involves not just following routines and instructions but learning when to depart from them. It requires sound, basic skills but also the ability to engage in higher-order critical and creative thinking, to find connections and combinations between ideas and concepts to unlock problems. Problem solving of this kind is rarely a purely cognitive activity. It's not just about being smart. It requires: persistence to overcome setbacks; a sense of animating purpose to drive you on; collaboration to engage the ideas and insights of other people; empathy to understand the needs of others; the ability to turn ideas into action and to test and improve them. Learning to be a creative problem solver requires a dynamic combination of cognitive and non-cognitive skills, hard and soft, explicit and tacit, academic knowledge and entrepreneurial ambition.

Schools achieve that mix in many different ways. But they share one common feature: they have to be dynamic places to learn. These schools do not fall prey to false dichotomies which separate the head and the hand, theory and action, the personal and the social. On the contrary, they get beyond these divisions and create new combinations. That is what makes them so dynamic. There is no better example of this mix in action than the remarkable Broadmeadows Primary School in one of Melbourne's most deprived outer suburbs.

Yousef is confident he is making good progress with his learning behaviour goal, proudly displayed on a badge on his shirt. "My learning behaviour goal is self-regulation," he explains calmly. "Which means I have to be better at looking after myself, not asking for help before I have tried to find a solution myself, staying focussed and helping out other people – for example, in the playground and staying in control of myself…" That explanation of what it means to be a self-regulating learner might not be that remarkable were it not for the fact that Yousef is just 5 years old.

Nor is that capacity for self-reflection about learning an isolated example. All over Broadmeadows, children rattle off how they are trying to develop as learners. One girl says she is trying to become more organised, which means having everything she needs to complete a task before the lesson begins. Another says she is trying to become more persistent, which means not giving up on a drawing when her effort does not turn out as hoped.

Broadmeadows follows a standard curriculum but underlying it is a set of behaviours that involve acquiring and testing knowledge, building personal strengths such as persistence, encouraging collaborative problem solving and taking action and responsibility. What Broadmeadows has learned, through a mixture of painful experience and drawing on the latest neuroscience, is that cognitive and non-cognitive development go together – there are no short cuts. Children often grow frustrated and bored when learning makes no sense to them and they find it impenetrable (a real challenge at Broadmeadows where a very high proportion of children are recent immigrants and do not have English as their first language). That frustration can often lead to behaviour issues and demotivation. Part of the answer is better pastoral care, to make children feel better about themselves. Yet the real solution is to enable students to acquire the tools they need to learn and so feel a sense of achievement. That is only possible, however, if students can become more self-controlled, cooperative and persistent. Learning not just the ingestion of knowledge but personal strengths and social skills, as well as a capacity for taking action, turning what you know into something that you can do.

It was through the work of neuroscientist and educator Judy Willis that Broadmeadows' Principal Keith McDougall came to see that the difficulties that many of his children faced were to do with brain development as much as behaviour: "Many of the problems our students face cognitively is that they have not had the kind of social learning and conversation that would help most

children knit together their neural networks. So our kids often have not had much conversation at home, especially in English, and may well have had little experience of structured game play. As a result, they often arrive at school without their brain having been able to develop in important ways. They also arrive carrying a lot of emotional distress. So it's not surprising that they grow frustrated when they cannot complete a basic task in school."

Broadmeadows is in the bottom 12% of districts in Victoria in terms of deprivation, yet the school's results are hitting the statewide average. That is because Broadmeadows has a highly personalised yet systematic approach to developing the basic skills and cognitive capacity of all students, including the kinds of learning behaviours that Yousef is acquiring.

"It's all a question of giving them the right strategies to tackle problems, whether those are maths problems or social problems or emotional challenges," McDougall explains. "Just making them feel a bit better about themselves for a while is not good enough. We have to give them tools so they can solve their problems for themselves, whatever shape those problems might come in, that's the lasting solution."

Schools like Broadmeadows and Templestowe, Col·legi Montserrat and School 21, are like creative communities, joined in the cause of making learning a dynamic, engaging and exciting experience. That is because the knowledge and skills young people need to be innovators, entrepreneurs, designers and problemssolvers cannot be acquired through education as instruction. Acquiring this suite of skills for life in a changing world is more like learning to swim than learning to do a quadratic equation.

At the heart of the process of dynamic learning is the teacher as an activator, in a school that creates a dynamic learning environment. These are the core components of a dynamic education. The challenge is to take this kind of learning to scale, to make it as ubiquitous as learning to read and write, to multiply and divide. That is what we turn our attention to next.

Discussion questions

1. Andreas Schleicher, Director for Education and Skills at the OECD and his colleague Qian Tang, Assistant Director-General for Education at UNESCO, frame the goal for education this way in their introduction to a report on the importance of basic skills: "Ensuring that all people have a solid foundation of knowledge and skills must be the central aim of the post-2015 education agenda. This is not primarily about providing more people with more years of schooling; in fact that is only the first step. It is most critically about making sure that individuals acquire a solid foundation of knowledge in key disciplines, that they develop creative, critical thinking and collaborative skills, and that they build the character attributes such as mindfulness, curiosity, courage and resilience."

    - How is this vision statement similar to the vision you've set in your school? How is it different?
    - What are the wider system implications to realise this vision?

2. According to the text, "Learning is the acquisition and assimilation of new knowledge, through an iterative and cumulative process… as new knowledge is integrated with old."

    - How do you approach pacing and instructional delivery to help students gain new knowledge by leveraging what they already know?
    - How can this approach be applied to the personal and social learning journeys as defined on page 39?

3. "Personal growth and learning are only possible in a social context, which is why dynamic learning has to be a collaborative enterprise." Do you agree with this statement?

    - What are some of the benefits of collaborative, social learning experiences?

- What are some of the challenges to fostering collaborative, social learning experiences?
- How could you evaluate/assess personal growth through social learning experiences?

4. "The skills of collaboration can be modelled and emulated, but they cannot be taught soley by a teacher at a blackboard or a textbook on the desk… Collaboration will also be ever more important to modern citizenship. Cultivating citizenship, an identification with a shared national history and institutions, has been a central goal for mass education systems created in the midst of industrialisation, urbanisation and migration. Yet, in the modern world and especially in cities, people increasingly self-organise and connect through digital platforms. Much of the time the citizens, in effect, rule one another, together, peer-to-peer. Young people all over the world are increasingly adept at harnessing the new power of peer-to-peer, do-it-together citizenship. Thomas Jefferson said that education should be an experience in self-governance, taking responsibility for one another and making decisions together."

   - Why are the skills of collaboration important for your students to learn? Where do you see them needing to call on this skill set?
   - Do you currently create opportunities for students to collaborate in your classroom? What benefits have you observed from this type of learning? What have been some of the challenges for you as the class leader and activator? For students working together?
   - (Working in small groups) Discuss how you implement collaborative learning experiences in your classroom. What are common best practices? Based on your colleagues sharing, what is one thing you plan to bring back and try in your own school?
   - How do you assess collaborative learning? Do you only access the final output? Do you assess the use of social skills in interactions between students? How?

Notes

Chapter 5

DYNAMIC EDUCATION AT SCALE

Sevenoaks School

How can education systems provide these kinds of learning experiences at scale for entire generations of young people, to shift education from "following instruction" to "solving problems"? That challenge has four main aspects.

- Making dynamic learning central to the curriculum that the majority of schools follow.
- Equipping systems to make a reality of such a curriculum in practice.
- Creating reliable assessments for the acquisition of non-cognitive skills.
- Building the public case with politicians, parents and employers to enable system-wide change.

Let's take each of those in turn.

Throughout the next few sections, you'll find mention of a number of exemplar curricula, systems and assessments. These have been compiled in the order that they are mentioned, along with links to additional information, in a Resources appendix toward the end of this volume.

5.1 A Dynamic Curriculum

Many countries have created national curricula or common standards to set out the knowledge and skills children should develop at different stages of their education. These frameworks are a vital part of education reform and improvement. They are unlikely to be dismantled. Which means the question becomes: Can national curriculum standards be compatible with the development of the intangible, personal and collaborative competencies that we value, but which are hard to specify in detail?

The schools profiled in this report are not *refuseniks*. They recognise the need to meet the requirements of the national curriculum, and not just for pragmatic reasons of accountability. As Sister Monika at Col·legi Montserrat puts it: the national curriculum is a good starting point, but it is not a ceiling. At many of these schools, the teachers start the year by mapping out the requirements of the national curriculum and then working out how to deliver those while developing personal and social skills, for example through project-based, real-world and interdisciplinary learning.

A prime example is the curriculum developed by the US-based Expeditionary Learning Schools (ELS) to teach common core standards for literacy entirely through forms of project-based learning.

About 150 schools have explicitly adopted the ELS model, a combination of Outward Bounds-style and project-based learning, largely inspired by the work of Ron Berger, one of the first to practice the idea that learning should be regarded as a craft skill.[19] ELS organise all their learning through expeditions that engage knowledge from across all school subjects focussed around key questions. At the remarkable Metropolitan Expeditionary Learning School (MELS) in Queens, New York for example, students in Year 9 had spent a term exploring the question "Built to last?" One student was preparing to give a presentation in praise of how monarchies had evolved and survived; another was going to talk about the engineering of New York's bridges. Another year group had looked at the statement – "It's a revolution", – exploring the nature of revolutions in art, science, politics and engineering. The

atmosphere at MELS is convivial: the students are involved in lots of discussions in teams and as a whole class. But it is also respectful and focussed on learning. As Patrick Finley one of the school's Co-Principals puts it: "The conventional wisdom is that rigour means following a textbook, with a teacher instructing the class from the front of the room writing things on the blackboard. We want to create a different kind of rigour, structured project-based learning. It is certainly much more demanding on teachers to plan ahead how they are going to lead students through acquiring the knowledge they will need to solve the problems."

> *"ELS is hoping that, by extending their curriculum, the dynamic attributes of their work will become a hallmark of entire systems."*

To extend their model, ELS has developed an online, open source curriculum to meet the common core standards for literacy using project-based learning. The curriculum has clearly resonated with the market: it has been downloaded 5 million times, an indication of the scale of the demand.[20] Berger explained: "Even with 150 schools using our model we were niche. This online, open source curriculum has allowed us to move into the mainstream and gain more influence over the mainstream system. Our argument to parents is that, with this approach, they can have both. Their children will get good test scores but they will also develop stronger character traits and personal skills, which will stand them in good stead later in life."

ELS is hoping that, by extending their curriculum, the dynamic attributes of their work will become a hallmark of entire systems. Indeed, many jurisdictions are already moving in this direction.

Some countries are reducing the burdens of their national curriculum, to leave more space for the development of social and personal competencies (a long-standing feature of Finland's curriculum.)[21] South Korea, for example, has just introduced more free time at school when children are encouraged to play, act, paint, explore and create, in an effort to lessen the emphasis on testing, and has piloted a Free Semester Program.[22] While South Korean students do well in tests, especially for maths, studies show they are also often unhappy at school.[23]

Several countries are developing hybrid curricula which foster a mix of skills. In Canada, Quebec is promoting cross-curricular and lifelong learning as well as sound knowledge of discrete subjects.[24] In Scotland, the goals of education include developing confident individuals, responsible citizens and effective contributors, alongside literacy and numeracy.[25] The Australian framework promotes 10 capabilities including: thinking skills, social competence, and ICT skills.[26] Spain's national curriculum already encourages the development of content knowledge as well as five competencies including creativity, critical thinking and collaboration.[27] Similar developments have been initiated in New Zealand[28] and Singapore, which has a "swiss roll" curriculum[29] – with core knowledge at the centre and non-cognitive skills in the outer rings. The Netherlands, which does not currently have a national curriculum, is embarking on a national debate over the future curriculum.[30] Based on the evidence, it would seem that curriculum development is unlikely to be the biggest obstacle in creating dynamic education systems. Instead, it is likely to be a major avenue for progression.

5.2 Dynamic Systems

The period between the late 19th and early 20th centuries was one of remarkable transformation. Systems of near universal education emerged from a wide array of local and voluntary provision. Schools spread because the "follow instruction" formula could be copied: school and classroom, teacher and lesson, blackboard and textbook, exercise book and register, desks and chairs.

What would it take for school systems to move toward more dynamic models of education, where students' problem-solving skills are developed day in and day out? Can the capacity to do that at scale be developed?

Austria is a good example of a country attempting just such a change. In response to lacklustre performance in the OECD's PISA rankings, Austria embarked on an ambitious approach to system-wide change with three main ingredients:[31]

- An academy for school leaders from every level of the system, bringing them together in groups of 300 for a year-long programme of

collaborative learning events, including the creation of local networks and teams. Teachers were encouraged to act as critical friends to one another. Improvement was framed as a personal undertaking as well as a systemic one.

- The creation of an innovative middle-school model, in which schools were invited to re-launch themselves as "new schools", embodying pedagogy focussed on skills including self-reliance, collaboration, resilience and teamwork. Teachers were encouraged to become "designers of learning" working in collaborative teams to make this shift.

- A dialogue forum in which the hierarchical skeleton of the formal system, and the networks of teachers and schools which make up its muscle, could come together in events designed as appreciative conversations.

Cities will be another focus for change. As societies become increasingly urbanised, education systems will be increasingly critical to the ability of cities to develop, attract and retain talent. That will drive city leaders to become education innovators, a phenomenon we have already seen. Amsterdam embarked on an open innovation competition in 2015 to create new kinds of schools.[32] New York continues to be a source of significant innovation, from the work of the iZone under Mayor Michael Bloomberg to the created ExtendedEd schools, which open from early to late to provide children with a place to combine school and non-school learning.[33] The sustained improvement of London's schools is based on investment in new buildings, the growth of good academies and, perhaps more importantly, the spread of collaborative improvement and learning.[34] The Asia Society has gathered 10 cities together in a Global Cities Education Network programme.[35]

Education needs to become a dynamic system that combines growing diversity in provision with common frameworks for achievement and constant experimentation, adaptation and learning. Diversity is being encouraged by academies and free schools in the UK[36]; free schools in Denmark[37] and Sweden[38]; Magnet[39] and Charter[40] schools in the US; Trust Schools in Malaysia, and so on. Schools are themselves creating international brands like Escuela Nueva, High Tech High, Summit Public Schools, Big Picture Learning, Expeditionary Learning, Bridge International Academies and Kunskapsskolan.

In New South Wales, Australia, one of the largest public school systems in the southern hemisphere, the Department of Education has allowed innovative school leaders to form the Future Learning Unit[41] to develop new ideas for the system as a whole. In New Zealand, schools are forming learning communities to share resources and ideas.[42] And education systems are poised to become even more dynamic through new digital platforms for learning, operating outside and alongside schools, often set up by new entrants such as online course provider Udacity with highly vocational, for-profit business models.

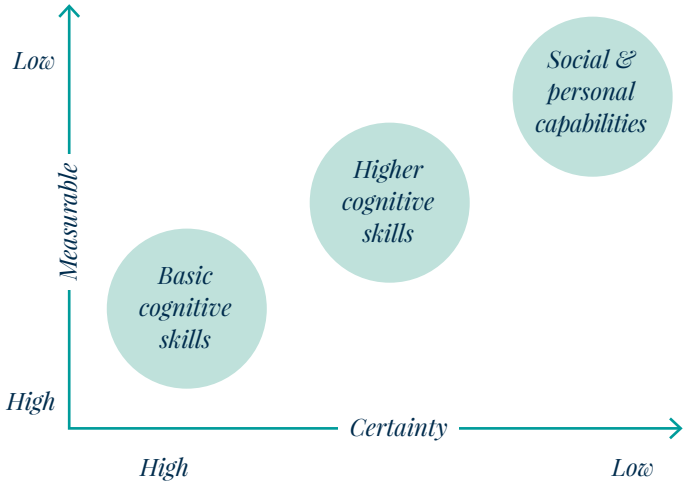
Efforts to create more dynamic education systems are underway, although the outcomes are uncertain. The next challenge is the toughest: can dynamic learning, across the wide set of cognitive and non-cognitive capabilities needed be assessed in reliable and effective ways?

5.3 Dynamic Assessments

The growing consensus that collaborative, creative and personal skills matter to student success, is belied by the way that schools and systems currently test individual, cognitive ability.

Exams work the way they do for very good reasons. Basic knowledge is reasonably easy to define and measure with reliability and validity, at scale, for millions of students, in fair and controlled conditions, at reasonable cost. The problem-solving capabilities that count in the modern world – social, personal and emotional strengths – are hard to measure in a standardised way without robbing them of the vitality that makes them special. Administering bespoke and open-ended tests moreover can be a costly business, at least using current technologies. It's also difficult to create entirely fair conditions: what if you are involved in collaborative problem solving with people who are demotivated and not particularly skilled? As a result, it is not difficult to see why school systems mete out more tests that can be counted easily, and focus less on those that are much more difficult to administer, despite the potential benefit.

No area of education is more blighted by false dichotomies than assessment, as Geoff Masters, the CEO of the Australian Council for Educational Research puts it: "The field of educational assessment is currently divided and in disarray. Fault lines fragment the field into differing and often competing philosophies, methods and approaches... The resulting dichotomies have become the default basis for conceptualising and describing the field: quantitative versus qualitative; formative versus summative; norm referenced versus criterion/standards referenced; tests versus assessments; internal versus external; continuous versus judgement; assessment of learning versus assessment for learning; and so on."[43]



As laid out by Peter Hill and Michael Barber in *Preparing for a Renaissance in Assessment*, assessment systems should: inform teaching practice; help learners to learn; accommodate, provide valuable information on, and assess the full range of important outcomes; and be of value for students across the ability range.[44] The norm, however, is almost exactly the opposite. Too often, tests are designed to measure what a student has learned at the end of a course, providing little support for learning during a course. Grade scores provide scant information about the rich array of what students can

do outside the artificial environment of an examination hall. Yet scores in these tests are central to high-stakes accountability systems that measure school and teacher performance. Assessment systems have become tools of certification and selection, to dispatch students to university, apprenticeships and into employment.

"Dynamic learning requires dynamic forms of assessment, both formative and summative, online and in action, in the exam hall and in the real world"

As Hill and Barber argue: "Accountability programmes run the risk of missing out some of the very (learning) outcomes that will underpin success in the future." Assessment is constraining learning rather than widening and deepening it, creating a bottleneck which threatens to hold back the entire sector, and with it, generations of students who need something better. The Harvard physicist Eric Mazur even goes so far as to call assessment the "silent killer" of learning.[45]

The challenges involved in assessing dynamic learning should not be minimised. Persistence, a growth mindset, resilience and cooperation are hard to quantify, and doing so runs the risk that they lose some of what makes them so vital. Assessing these skills typically requires judgement rather than the application of standard measures, and that means assessment can be variable, unreliable and costly to administer and moderate. Many of these skills – much like swimming – can only be displayed in their performance. It's difficult to replicate the conditions for the performance and so that makes it hard to be fair to all students. Collaboration is a large component in many of these activities. How well a student does will depend on who they are working with and that makes it hard to create measures that are fair for all students.

In Hill and Barber's view, however, all is not lost: "We believe that the possibility now exists to bring about an assessment renaissance that will help secure a floor of high standards for all, remove current achievement ceilings and support a focus on those higher-order thinking, interpersonal and intrapersonal skills vital for living and learning in the 21st century."[46]

Their confidence rests on the mass of innovation going on at the fringes of the mainstream system. Dynamic learning requires dynamic forms of assessment, both formative and summative, online and in action, in the exam hall and in the real world. That is precisely what these innovators are creating.

The International Baccalaureate Diploma Programme, for example, has a tried and tested method for assessing deeper, analytical knowledge through its extended essay and its Theory of Knowledge module.[47] Sevenoaks is just one of several schools developing its own (externally moderated) qualifications in subjects such as English because the school believes the GCSE exams do not sufficiently reward depth of reading and insight. The difficulty of replicating that system, reliably and at scale, may create an opportunity for sophisticated, dynamic online testing which sets students questions and challenges attuned to their ability and performance. As Hill and Barber argue: "Computerised assessment opens up the prospect of presenting students with tasks that are interactive, that make use of simulations in which students manipulate variables to achieve a desired result, that are dynamic, with the task itself subject to new information and changing circumstances." These systems could be reliable, affordable, dynamic *and* designed to allow students to engage in higher-order thinking and problem solving.

A complementary approach will be to use rubrics common in music, drama, art and dance, to judge the performance of skills like collaboration, persistence, creativity and problem solving. Music examiners, for example, use rubrics to give a categorical grade (rather than a relative ranking) to a student's performance.[48] According to David Conley and Linda Darling-Hammond similar rubrics can be used for judging speaking, laboratory experiments, mending a flat tyre, developing a business plan or performing with a drama group, in which the performance and the process matter as much as the product – be that an essay, a play, or a working car.[49]

These assessments may not always yield a definitive test score but more qualitative descriptions of the extent to which a student has demonstrated attributes, which are valuable precisely because they are hard to quantify. Moreover, to make the system efficient, schools might be licensed to make these judgements with random, controlled testing of the *school's* ability to set tests, rather than the students' ability to pass tests. Templestowe College, for example, has signed a deal with several universities to accredit students as "ready for university study" regardless of their test scores in the school leaving exam.

The colleges have in effect agreed to trust Templestowe's judgement as to the readiness of its students. The universities believe this will give them access to Templestowe's highly motivated and entrepreneurial students, and Templestowe can offer students a route to university that does not rely on doing well in school leaving exams, opening up post-secondary opportunities to more students.

Another approach would be to allow students to develop a CV of real-world achievements to add to their school leaving certificates, as they do at Templestowe College. New forms of entrepreneurial accreditation are emerging, such as the Aldridge Specification[50] and the CREATE framework devised by Studio Schools Trust.[51] The Mozilla Foundation and its tech company partners are creating vocational badges that students can work for outside normal school programmes, as is Pearson through Acclaim.[52]

Meanwhile the Knowledge is Power Program (KIPP) Public Charter Schools have their character scale and the Character Counts! coalition is just one organisation developing similar tools.[53] The Open University has developed measures of resilience and persistence, to help students manage their own motivation while undertaking distance learning. The Trust Schools network in Malaysia, set up to create an alternative to the rigid, test-driven school system, have developed student outcome measures to capture the progress – creative, social, personal and emotional – of a child across their school career.[54] Mission Skills Assessment, a US company, claims to have a scientifically based assessment of six character traits – teamwork, creativity, ethics, resilience, curiosity and time management.[55] An overall assessment of each trait is assembled by combining student self-reports, teacher observation and situational judgements.

Currently, too many systems demand that students acquire the knowledge that assessment systems mandate. Instead, assessment should be designed to help students acquire the skills they need to succeed. Moving forward, increasingly dynamic assessment systems will involve both formal testing and lots of informal peer-to-peer and self-assessments, meaning that students will need to become more used to giving and receiving constructive feedback that will help them learn and improve. This will be one of the most important skills students need beyond school. These systems will also have ceilings that rise and expand as student performance improves. They will go beyond testing routine recall of facts to test higher-order thinking, problem solving and creativity. And they will deliver qualitative descriptions and expert judgements of how well a student performs, as well as test results and grades.

Discussion questions

1. What would it take for school systems to move toward more dynamic models of education, where students' problem-solving skills are developed day in and day out? Can the capacity to do that at scale be developed?

2. "Currently, too many systems demand that students acquire the knowledge that assessment systems mandate. Instead, assessment should be designed to help students acquire the skills they need to succeed."

    - Can dynamic learning be assessed in reliable and effective ways? What core ingredients would be required to do this?

Notes

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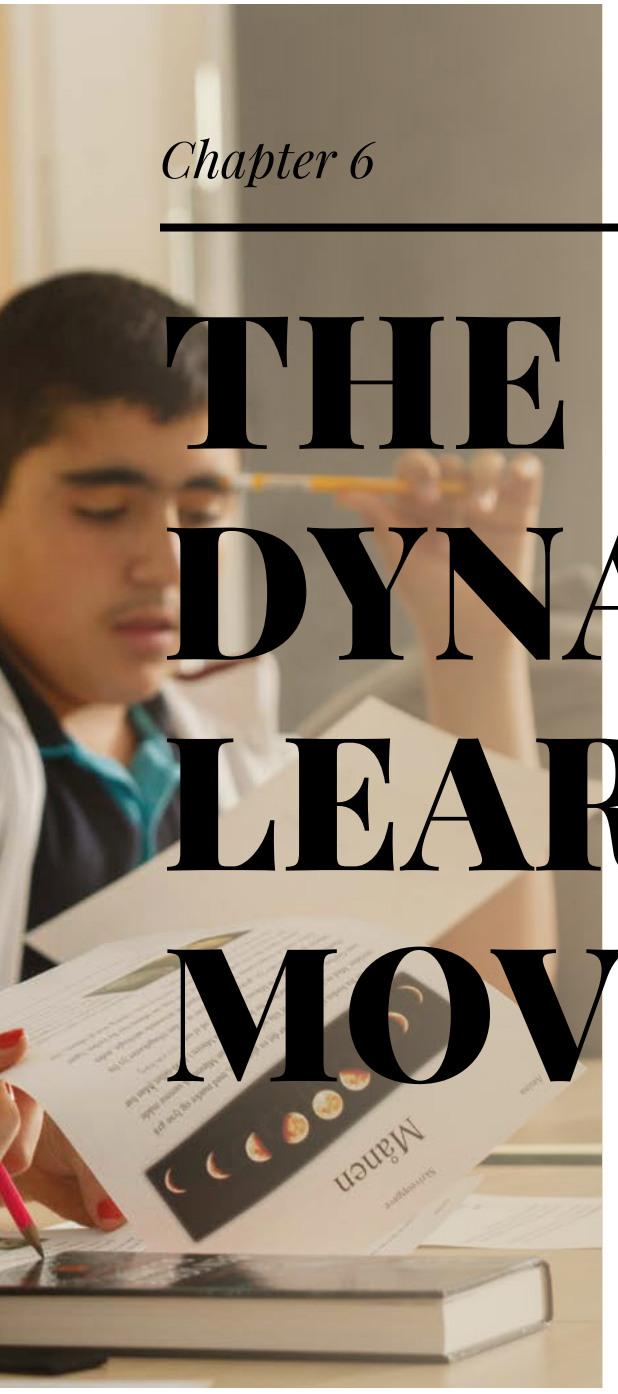


Chapter 6

THE DYNAMIC LEARNING MOVEMENT

Widespread social innovation requires the confluence of many interests to create the resources, infrastructure and norms for widespread change. In the late 19th century in cities across Europe, working class people started to wash themselves because they had indoor plumbing for the first time, drawing on public water systems, and an innovative easy-to-use commercial product: cheap soap.

But a revolution in ideas and norms was also critical. People were used to being dirty. Many thought dirt kept them healthy. Cleanliness involved a revolution in what people expected from one another, combined with advances in germ theory that persuaded people that washing was a good thing. We need a similar social transformation in what we expect from schools and learning, not just in formal systems and infrastructure, but in norms and expectations.

The good news is that the schools in this report are not lone mavericks. They are part of a growing global movement which operates just below the radar of national politics and media.

The most influential calls for a more dynamic approach to education are coming from employers concerned that schools are not developing the skills young people need for work. In 2012, the Confederation of British Industry, published *First Steps: A New Approach for Our Schools*, which argues that schools should focus on outcomes beyond the narrowly academic, such as collaboration, which will help students thrive at work.[56] In 2016 the Institute of Directors issued a report making similar arguments.[57] A Boston Consulting Group study for the World Economic Forum came to similar conclusions.[58] Information technology companies were instrumental in promoting what has become the Partnership for 21st Century Learning, which focusses on collaboration and creativity for the digital economy.[59]

This movement is informed by a growing body of academic research, including the work of Carol Dweck, Angela Duckworth, Tony Wagner,

John Hattie, Charles Fadel, and Linda Darling-Hammond to name just a few, lending considerable weight to the role of non-cognitive skills in long-term student success.

Foundations and think tanks are helping to turn these ideas into action. In the UK, the Royal Society for the encouragement of Arts, Manufactures and Commerce (RSA) led the way with its Opening Minds curriculum, which it is putting into action in a string of academies.[60] The LEGO Foundation is exploring "hands on, minds on" learning to develop "soft skills" learned through structured play.[61] The Asia Society has created a Global Cities Education Network, involving cities from Asia and North America to create a framework for the development of softskills.[62] The Hewlett Foundation is promoting deeper learning.[63] Think tanks such as the Center for Universal Education at the Brookings Institution, the Center for Curriculum Redesign at Harvard and the Global Education Leaders' Partnership are helping to draw this thinking together into common frameworks, underpinned by research.[64]

International institutions are playing an influential role in encouraging jurisdictions to share the risk of taking a different approach. UNESCO is promoting "transversal competencies" which cut across the subject knowledge that young people acquire at school.[65] One of the most significant developments is at the OECD, where the Education 2030 project is convening a global effort to create a shared competency framework.[66]

Systems, even large and unwieldy ones, can change but it generally requires a combination of four factors.

- First, the existing system has to start losing legitimacy because its performance stalls. Many of the best performing school systems have already hit a performance plateau.

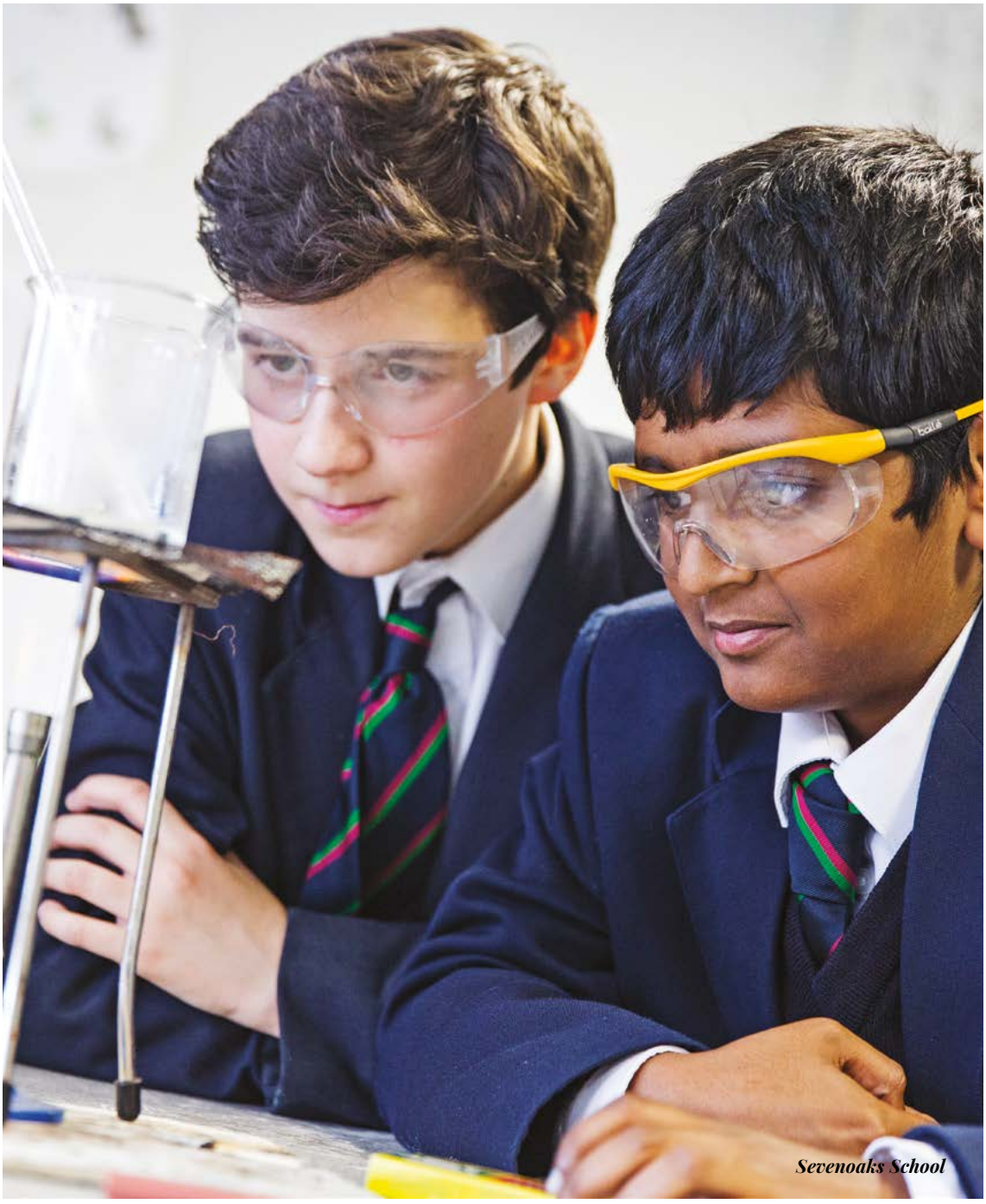
- Second, ideas for a new kind of approach, however utopian, need to spread and gain support. The upsurge in the global experimentation with dynamic learning is proof of that.

- Third, viable models need to move from the margins and into the mainstream, to deliver this different approach at scale. Schools of the kind described in this report are proving that is possible, along with the new

curriculum and teaching practices being developed in many jurisdictions. Innovation in assessment is the most important next step.

- Fourth, and critically, regimes change only when a significant body of insiders decide to switch sides. That then signals to others that it is time to follow suit. The legitimacy of the regime collapses from within.

The first three of these factors are already underway; the fourth needs work. To make progress, three other groups need to be brought into this movement for change: parents – a vital, often highly risk-averse, constituency; higher education, because university entrance requirements shape the kinds of exams children do at school; politicians who need to be shown that voters will be made more prosperous and successful by embracing dynamic learning. These three groups, by and large, still favour traditional, academic measures of knowledge to assess outcomes in education. Until they are also prepared to change it will be difficult to shift entire systems in a new direction.



Sevenoaks School

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Chapter 7

LEARNING TO BE MORE HUMAN

School 21

What is at stake in the debate over the future of learning is not whether school systems rise or fall in the PISA rankings. It is about how well education prepares young people to flourish in a society awash with intelligent technology, facing an uncertain future, with endless opportunities for collaboration but also deep-seated and urgent challenges which need addressing.

We need to learn how to become more human even as society becomes more technological, to become more creative as work becomes more programmed, to be more empathetic as systems become more pervasive, to take the initiative rather than meekly follow instructions, to work together rather than go it alone. We are not robots. We need to excel at being human. That is why we need our education systems to become more dynamic.

The long race between education and technology is entering a critical phase. History tells us that technological innovation drives productivity growth. Eventually that generates higher incomes and demand for new products and services that, in turn, become the basis for new jobs. Industrialisation and automation displaced human labour, first from agriculture and then from manufacturing, but in time new industries and jobs were created: farmers and fishermen in one generation became factory hands and foremen in the next, and then office clerks and systems analysts, hairdressers and personal trainers.

Yet the wave of technology about to wash over, some would say engulf, our economies is potentially very different from what has gone before.

New generations of intelligent machines, which can learn, adapt and improve on the job without any human intervention, will excel at routine tasks, which involve following and then improving protocols and rules for making decisions, allocating resources and moving people around. It is not just that robots will work all day long, without rest or food, without anger or worry about

the purpose of life. Every job that involves routine processing and decision making, like flying an airplane, might well be done better by systems, such as autopilot. In future those systems will be able to upskill themselves more quickly than humans. A Bank of England study found that 15 million jobs in the UK were at significant risk from automation. In the US the figure is 80 million.[67] Another study suggested that 85% of the jobs in the developing world, in call centres and factories, could be at risk.[68] The peak use of horses in the modern economy was just after WW1: the US economist Brad DeLong has speculated that we might reach "peak human" sometime this century.[69]

Adapting to this potential mass displacement of routine, cognitive white collar, middle-income jobs will require a reinvention of both work and education. The jobs of the future will depend on creative problem solving and personal services that require teamwork and empathy. People will have to be entrepreneurial for much of the time, even if they work within a company, making and remaking their own jobs. Learning should promote skills of collaboration and problem solving, making and designing, empathy and emotional acuity, rather than dutiful diligence in following a routine to deliver the expected answer at the appropriate moment. Current education systems risk preparing us to become second-rate robots. Instead, we should do what robots cannot do well, by learning to become more human.

That is because humans still have an edge so far as high-level reasoning, metaphor, and social and emotional skills are concerned. We are good at making leaps of understanding and imagination, employing empathy and intuition, in solving problems that require creativity and collaboration. That is why we must spread the dynamic education approaches described in this paper. If robots excel at providing what is expected, we need to excel at providing what is unscripted, unexpected, surprising and uncalled for. Instead of learning only to do exactly what we are told, we will need to learn to do what we think people need, what seems right, interesting and creative. And, we will ultimately be responsible for directing our smart technologies responsibly, ethically and well.

Education will only respond to this challenge if it puts aside the protracted and costly civil war that has pitched standards against creativity, traditionalists against progressives, knowledge of content against personal growth and social skills. The most promising development in education around the world is that a vast and highly productive new middle ground is opening up, where a highly practical common sense is taking hold which rejects these false dichotomies.

Those who draw inspiration from the progressive tradition of John Dewey and Paulo Freire acknowledge the importance of getting students good results and working within systems of accountability. Those who have supported a standards-driven agenda to reform and improve schooling now recognise that even the best systems are hitting a performance plateau, and even good schools can prepare young people badly for a world which requires creative problem solving. All the schools profiled in this report want to provide students with *both* sound knowledge *and* the capacity to be collaborative, creative and to turn ideas into action. That kind of dynamic education, in dynamic schools, designed by dynamic teachers will be vital to our collective future.

Discussion questions

1. What is the argument for teaching students to "become more human"?

2. How do you think about "being more human" in the context of increasing technological advances? What are the implications for all of us as we think more about lifelong education?

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Resources

Links to more information about the curricula mentioned in Section 5.1 A Dynamic Curriculum

Col·legi Montserrat: High-level information on the curriculum can be found at http://www.cmontserrat.org/en/montserrat-school

Expeditionary Learning Schools Curriculum: http://eleducation.org/resources?typeCategory=365

Finnish Curriculum: www.oph.fi/english/education_development/current_reforms/curriculum_reform_2016

South Korean Curriculum: http://ncic.kice.re.kr/english.kri.org.inventoryList.do

Quebec Curriculum: www.education.gouv.qc.ca/en/curriculum

Scottish Curriculum: www.educationscotland.gov.uk/learningandteaching/thecurriculum

Australian Curriculum: www.australiancurriculum.edu.au/curriculum/overview

Spanish Curriculum: www.mecd.gob.es/educacion-mecd/areas-educacion/sistema-educativo.html

New Zealand Curriculum: http://nzcurriculum.tki.org.nz/The-New-Zealand-Curriculum

Singaporean Curriculum: www.moe.gov.sg/education/syllabuses

National debate on the future Dutch curriculum: www.huffingtonpost.com/esther-wojcicki/a-moonshot-in-education-i_b_8028052.html

Links to more information on the examples mentioned in Section 5.2 Dynamic Systems

Austria's System Wide Change: Schiley, W. and Schratz, M. (2011). Developing leaders, building networks, changing schools through system leadership. In T. Townsend and J. MacBeath (eds.), *International handbook of leadership for learning*. Springer International Handbooks of Education 25.

Dutch Crowd Sourced Curriculum: www.huffingtonpost.com/esther-wojcicki/a-moonshot-in-education-i_b_8028052.html

iZone NYC: http://izonenyc.org

ExtendEd: www.nydailynews.com/new-york/nyc-school-day-late-6-pm-article-1.1330698

School Improvement in London: http://cdn.cfbt.com

Global Cities Education Partnership: http://asiasociety.org/global-cities-education-network

UK free schools and academies: www.gov.uk/types-of-school/free-schools

Danish free schools: www.friskoler.dk/en/front-page/the-history-of-the-free-schools/

Swedish free schools: https://sweden.se/society/education-in-sweden/

American Magnet Schools: www.publicschoolreview.com/blog/what-is-a-magnet-school

American Charter Schools: www.publicschoolreview.com/blog/what-is-a-charter-school

Malaysian Trust Schools: www.yayasanamir.org.my/

Escuela Nueva: www.escuelanueva.org/

High Tech High: www.hightechhigh.org/

Summit Public Schools: www.summitps.org/

Big Picture: http://bigpictureeducation.com/

Expeditionary Learning Model: http://eleducation.org/

Bridge International Academies: www.bridgeinternationalacademies.com

Kunskapsskolan School Methodology: www.kunskapsskolan.com

Future Classrooms in New South Wales, Australia: www.nsw.gov.au/news/future-classrooms-unveiled

New Zealand Learning Communities: http://elearning.tki.org.nz/Professional-learning/Learning-communities

Links to more information about the curricula mentioned in Section 5.3 Dynamic Assessments

International Baccalaureate Diploma Programme extended essay and Theory of Knowledge module: www.ibo.org/programmes/diploma-programme/curriculum

Sample assessment rubrics for the arts: www.nationalartsstandards.org

Aldridge Specification: www.aldridgefoundation.com

CREATE framework devised by Studio Schools: http://studioschoolstrust.org/studio-schools/create-framework

Mozilla Open Badges: http://openbadges.org

Acclaim badges: www.youracclaim.com

KIPP Character Scale: www.kipp.org/our-approach/character

Character Counts! Framework: https://charactercounts.org/program-overview/six-pillars

Trust Schools Student Outcome Measures: www.yayasanamir.org.my/?page_id=77

Mission Skills Assessment: http://indexgroups.org/msa/

Links to more information about the examples mentioned in Section 6 The Dynamic Learning Movement

Partnership for 21st Century Learning: www.p21.org/

RSA Opening Minds curriculum: www.rsaopeningminds.org.uk/about-rsa-openingminds/

Lego Foundation Future of Play: www.legofoundation.com/en-us/research-and-learning/foundation-research/the-future-of-play

Asia Society Global Cities Education Partnership: http://asiasociety.org/global-cities-education-network/21st-century-skills

Hewlett Foundation Deeper Learning: www.hewlett.org/programs/education/deeper-learning

Centre for Universal Education framework: www.brookings.edu/research/reports2/2016/04/millions-learning

Centre for Curriculum Redesign framework: http://curriculumredesign.org/wp-content/uploads/CCR-FoundationalPaper-Updated-Jan2016.pdf

Global Education Leaders Programme framework: http://gelponline.org/sites/default/files/GELP-A-Global-Movement-2016-17-v2.pdf

UNESCO Transversal Competencies: http://unesdoc.unesco.org/images/0023/002319/231907E.pdf

Education 2030 Shared Competency Framework: http://unesdoc.unesco.org/images/0024/002432/243278e.pdf

School Profiles

Name: Broadmeadows Primary School
Type: Primary
Location: Broadmeadows, Victoria, Australia
Age Range: Prep – Grade 6, Ages 5–12
Number of Students/Size: 270
Additional funding provided by the government to support low-income students: N/A
Who they serve: Broadmeadows serves students from a deprived outer suburb of northwest Melbourne, a district which is in the lowest 12th percentile for socioeconomic disadvantage.
Website: www.bps.vic.edu.au

Also... Students of Broadmeadows Primary School often take it upon themselves to intervene when students are treating others in a way that's different to the expectations placed on them and this quite often resolves the issue before it reaches the teachers.

Name: Broome Street Academy Charter School
Type: Public Charter High School
Location: New York City, USA
Age Range: Grades 9–12, Ages 14–18
Number of Students/Size: 330
Additional funding provided by the government to support low-income students: Yes
Who they serve: Broome Street Academy is a tuition-free public charter high school devoted to providing students with the necessary skills and support to graduate prepared for a successful future beyond high school. Their admissions policy gives preference to siblings and students who are homeless, in foster care, or from low-performing schools in all five boroughs of New York City.
Website: www.broomestreetacademy.org

Also... The Academy opened in 2011. They hold their students to five pillars of excellence to support their development in becoming well-rounded, valuable and value-added citizens. The five pillars of PRIDE include: Professionalism, Resilience, Investment, Dignity, Empathy. The Academy provides non-academic services through a close partnership with a youth development organisation, integrating academics and youth development services under one roof. Social-emotional needs are met through their CHAMPION Model©.

Name: Col·legi Montserrat
Type: Private, religiously affiliated
Location: Barcelona, Spain
Age Range: 0–18 years
Number of Students/Size: 1,046
Additional funding provided by the government to support low-income students: N/A
Who they serve: The school is committed to what they call "global" education. They aim to shape the minds and souls of children and youngsters from a very early age, by giving them the tools they will need to achieve human, physical, intellectual, spiritual and social excellence.
Website: www.cmontserrat.org/en

Also... The Col·legi was founded in 1926. They have radically disruptive nuns. Their motto is "Excelsior, always higher and higher."

Name: Metropolitan Expeditionary Learning School
Type: Public school
Location: Forest Hill, Queens, NY, USA
Age Range: Grades 6–12, Ages 12–18
Number of Students/Size: 817
Additional funding provided by the government to support low-income students: Yes
Who they serve: The school serves grades 6–12. Any 5th grade student who attends a District 28 Elementary School or is zoned for a District 28 middle School. Any 8th grader can apply for high school. Last year they had 2,500 applicants for 150 seats.
Website: www.metropolitanels.com/MELS/Home.html

Also... The Metropolitan Expeditionary Learning School offers all students a rigorous college preparatory programme, with particular emphasis on sustainability. Students participate in fieldwork with civic leaders, industry figures, and environmental scientists to examine agriculture, architecture, city infrastructure, design, environmental policy, law, and planning. They are partnered with EL Education and NYC Outward Bounds Schools.

Name: School 21
Type: Free School
Location: Newham, London England
Age Range: 4–18
Number of Students/Size: 75 per year group, approximately 450 overall
Additional funding provided by the government to support low-income students: Yes
Who they serve: They are a non-selective, state-funded school serving children of all abilities. They have a fair admissions policy in line with other Newham schools. Places are allocated to those who live nearest to the school as well as of course providing for those with a Statement of Educational Need and those who are in the care of a Local Authority.
Website: http://school21.org.uk

Also... They believe that by focussing school around developing the six attributes of Expertise, Eloquence, Grit, Professionalism, Craftmanship and Spark, they will be able to achieve their dual aims - for students to create beautiful work that makes a difference to their community today, and for students to be best prepared for the world that they will meet upon leaving school.

Name: Sevenoaks School
Type: Private, co-educational day and boarding school
Location: Sevenoaks, Kent, England
Age Range: 11–18 Years
Number of Students/Size: 1,050
Additional funding provided by the government to support low-income students: No

Who they serve: Sevenoaks has an international student body, including pupils from over 40 countries.
Website: www.sevenoaksschool.org/home

Also... Founded in the 15th century, the school has a superb 100-acre campus in the Kent countryside. They were rated 'exceptional' in their latest Independent Schools Inspectorate report for teaching and learning.

Name: Shireland Collegiate Academy
Type: Academy
Location: Smethwick, Sandwell, West Midlands, UK
Age Range: 11–18
Number of Students/Size: 1,100+
Additional funding provided by the government to support low-income students: Yes
Who they serve: Shireland Collegiate Academy is a large inner city secondary school that serves the local community. The Academy is a Teaching School (one of only three in deprived areas) and was the National Pupil Premium winner for the West Midlands in 2015.
Website: www.thelearningbank.co.uk/shireland

Also... Shireland opened as an Academy in 2007. Over the past few years the Academy has gained a reputation for effective use of technology to improve standards, innovative curriculum design and embedding new approaches to learning. The Academy has been judged as Outstanding by Ofsted in 2006, 2010 and 2013.

Name: Te Kura Kaupapa Māori o Te Koutu
Type: Maori Medium School
Location: Nelson, New Zealand
Age Range: Year 1 – Year 13, 5–18 years
Number of Students/Size: 200–230
Additional funding provided by the government to support low-income students: All Kura Kaupapa Māori schools receive additional funding to help them develop and maintain their Te Reo Māori language immersion environment.

Who they serve: Serves school age Te Arawa Māori children.
Website: N/A

Also... The school was founded in 1993. Their motto is Mahia e tōna ringa, tino kai tino mākona, which translates to "Success gained by one's own hand is the best and the most enjoyable."

Name: Templestowe College
Type: Government Coeducational School
Location: Lower Templestowe, Victoria, Australia
Age Range: Year 7–Year 12, Ages 12–17
Number of Students/Size: 790
Additional funding provided by the government to support low-income students: N/A
Who they serve: Most schools expect the students to fit in with the school, rather than the school trying to adapt to best meet the needs of the individual student. Templestowe thinks very carefully about the direction the school is heading. They want to be leaders and innovators, not followers, and they want to inspire these qualities in their students. They believe that the education programmes they are now putting in place will be replicated in many schools in five to 10 years' time, simply because the existing model of education does not work for so many students.
Website: www.templestowec.vic.edu.au

Also... Templestowe was built as a technical school in the 1970s. Students work for a living as part of everyday school life. They encourage students to take control of their own learning, and removed all reference to year levels in 2015. Each student has their own individualised learning plan, selecting subjects from more than 150 electives. Students sit on the curriculum committee, and sit on staff selection panels. If any student staff or parent has a suggestion, the default answer must be "yes", unless to do so would take too much time too much money or negatively impact on somebody else.

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