Equinox Blueprint
Learning 2030

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W G S I

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Acknowledgement

Foreword

Imagine if we could gaze into the future and see the implications of our present-day approaches to important challenges. What would we do differently now to help build a better world for the next generation?

This question is the impetus behind Waterloo Global Science Initiative's Equinox Summit series, a biennial gathering of experts from around the world aimed at tackling tomorrow's biggest challenges and seizing opportunities today.

In 2011, Waterloo Global Science Initiative's inaugural Equinox Summit: Energy 2030 explored how cutting-edge science and technology can contribute toward a more sustainable energy future. The ensuing Equinox Blueprint: Energy 2030 outlined the collective conclusions and energy policy recommendations drafted by more than 40 experts who participated in the weeklong summit.

Two years later, Waterloo Global Science Initiative shifted its focus to the *intellectual* energy that will drive the future by tackling questions of education reform. This past fall, Equinox Summit: Learning 2030 assembled a diverse group of education innovators from around the world to develop practical, implementable ideas for improving high school education.

Why high school? Whereas early childhood education and post-secondary education have been the subjects of much debate and change, high school – where children become young adults and determine their future paths – is a comparatively neglected piece of the puzzle. High school is often perceived as a means to an end – a pipeline through which the highest-scoring students are funnelled toward post-secondary institutions or careers – rather than a crucial period of a person's intellectual, emotional, and ethical development.

If children born today are to become the successful high school graduates of 2030, the time is now to create the blueprint for an ideal school of the 21st century.

Participants at Equinox Summit: Learning 2030 made recommendations in nine crucial areas of the learning ecosystem with great opportunities for transformation: curriculum, pedagogy, teachers, learning environments, assessment, organization, scalability, cost/funding, and implementation. Collectively, the recommendations form an interconnected picture of the optimal future of learning.

As Chair and Vice-Chair of WGSI's Board of Directors, we are pleased to share the ideas and proposals generated by the participants. In the months to come, their efforts will be encapsulated in an evolving, living blueprint that fuels the global conversation and public engagement in the future of education. We invite you to explore this vision of the future and to follow our continuing activities at *wgsi.org*.

Neil Turok and
Feridun Hamdullahpur

About WGSI

Founded in 2009, Waterloo Global Science Initiative (WGSI) is a non-profit partnership between Perimeter Institute for Theoretical Physics and the University of Waterloo, a pairing that has previously resulted in the distinguished Perimeter Scholars International program and the University of Waterloo's pioneering Institute for Quantum Computing. WGSI's mandate is to promote dialogue around complex global issues and to catalyze the long-range thinking necessary to advance ideas, opportunities and strategies for a secure and sustainable future. The organization's core activities include the Equinox Summit Series, Equinox Blueprints, Equinox Fellowship for young leaders, and a range of impact activities programmed around each summit topic and its outcomes.

Executive Summary

A child born today will graduate from high school into a very different world. By 2030, simply knowing facts will have little value. Education will need to equip learners to think creatively, independently, rigorously, and collaboratively in full awareness of themselves and their social context. How do we get there from here?

It is time for education systems to evolve. Even our most capable and committed teachers are sometimes struggling to prepare students for the 21st century while working within an educational model developed for the 19th century. The antiquated nature of this model is clearly causing problems for students. Today, about a third of the world's children never begin high school, and many of those who do start will drop out before the end. Even those who finish often end up disengaged from learning. This represents an enormous loss of human potential – and a huge economic cost to society. We ought to do better.

And the good news is we know we can. In a few places around the world, innovative educators are effecting change, and creating the flexible, agile learners the 21st century requires. The goal of the Equinox Summit: Learning 2030 was to identify these beacons of change, assemble them into a coherent vision of learning, and map out a way to make this vision not just an occasional reality but the norm.

At Equinox Summit: Learning 2030, Waterloo Global Science Initiative brought leaders in education, teaching professionals, researchers, and policymakers together with young people who have innovated in their learning journey. This unprecedented gathering represented six continents, diverse socioeconomic backgrounds, and disenfranchised and disadvantaged communities to give a truly global and intergenerational perspective on learning. Together, the group created a vision of a scalable, affordable, sustainable learning system for the high school graduates of 2030 and beyond.

We present our vision here in the Equinox Blueprint. The results of our deliberations have convinced us that every child, no matter where they live in the world, can develop the skills and character needed to thrive in 2030 and beyond.

We think this is a future worth working toward.

The goals of Learning 2030

In order for high school graduates to reach their full potential in life, they need to be:

- Lifelong learners who can identify and synthesize the knowledge needed with depth and rigour to address a wide range of challenges in a complex, uncertain world
- Able to read, write and work with numbers
- Creative, critical thinkers
- Able to collaborate effectively with others, especially those of different abilities and backgrounds
- Open to risk-taking as an essential part of progress
- Adaptable and resilient in the face of adversity
- Aware of the society they live in and able to understand the different perspectives of others
- Self-aware and cognizant of their own strengths and limitations
- Ethical, self-motivated, and eager to tackle the challenges and opportunities of their world

To achieve these goals, we require a different structure for learning, one in which traditional concepts of classes, courses, timetables, and grades are replaced by more flexible, creative and student-directed forms of learning. This develops deep conceptual understanding, which can then be applied in other contexts. In particular, we envision a system in which:

1. Learning focuses more on the development of lifelong learning practices and a sense of self, rather than specific facts and figures. Learners have a well-rounded base of knowledge and a core set of skills, while establishing a depth of expertise in areas of interest that are framed by fundamental Habits of Mind, including:

- An intrinsic motivation to learn and explore
- An awareness of individual, local, and global contexts
- A recognition that failure is an essential part of progress

- An awareness of the limits of one's knowledge and the possibility of being wrong
- A curiosity about the world and the way it works
- An ability to recognize inequity and imbalance in systems
- An empowerment and drive to translate knowledge and passion into meaningful action

2. Students learn through cross-disciplinary and often collaborative projects. These projects allow students to build a balance between doing and knowing while examining particular areas of knowledge with depth and rigour. Since students' interest in the subject will make a big difference to their motivation, they select their own subjects for these in-depth projects, with guidance from their teachers.

Students are most engaged when their studies are relevant. Therefore, learners actively seek partnerships with industry, civic organizations, media, and other local groups so that their learning activities are directly related to the needs of their society.

3. Students connect with each other in fluid groupings that are dictated by their needs at any given moment. Often, these groups may combine students of different ages, different levels of attainment, and different interests. These groups may seek guidance from several different teachers and other advisors as facilitators and subject-matter guides.

4. Teachers and other learning professionals serve as guides or curators of learning. These learning partners help students select topics for in-depth learning, define goals, and find and evaluate information. They also help connect students with experts outside the school and facilitate discussions among students, experts, and others. Teachers' in-depth knowledge of and passion for their subject areas are central to their role, but a broader passion for their own lifelong learning and helping others learn is also essential.

Teachers play a second crucial role in learning: that of a caring, interested mentor and role model. Each student meets regularly with a teacher/mentor to discuss the student's goals and the educational trajectory that is most likely to achieve them, and to monitor the student's progress.

5. Learning progress is measured through qualitative assessment of a student's skills and competencies that document the learner's entire experience, rather than measuring a discrete outcome. These assessments are determined collaboratively by the learner and others including teachers, peers, parents, and outside mentors.

Personalized assessments are a regular, even daily, part of students' learning process, though particular attention may focus on milestones such as completion of a major project. As a result, students know at all times what their strengths are, where they have room for improvement, and how they are addressing their progress. This process takes the place of conventional high-stake examinations and grades.

6. The framework for learning in a jurisdiction is a collective decision of stakeholder groups comprising learners, teachers, parents and government bodies. Within that framework, each local school has the autonomy to decide the method it will use to pursue the learning goals, with learners and teachers playing a central role in the decision-making.

7. Schools empower both students and teachers, encouraging them to experiment with new ideas and fail safely, so that they develop the confidence to take risks. This includes the creative use of available technologies situated in different contexts within the education ecosystem. Available technologies are explored in a culture that embraces experimentation and allows failure to be used as an opportunity for improvement. Teachers pursue their own research on instructional techniques, both to advance their own knowledge and to set an example of risk-taking and perseverance for students to emulate. Teachers seek rapid feedback about whether innovations are working. This results in a dynamic, evolving learning system capable of adapting to different social conditions and to continued technological change.

We are convinced that moving toward this vision of learning will help to shape a world filled with creative, confident, and adaptable young leaders capable of addressing the challenges of a complex and fast-changing society. Exemplar schools already in place testify that this need not cost more than today's educational system – and society will reap immense benefits. The world could make no smarter investment, and the time to invest is now.

"Education is the most powerful weapon which you can use to change the world."

– Nelson Mandela

Classroom collaboration in Uganda

Introduction

In the last few decades, scholarship on education has been booming, creating a vast depository of information and experience about how to optimize learning.[1] This has put us on the threshold of a great opportunity: if we synthesize and leverage these insights we can make a real difference in the global outcomes of education.

The children born in 2013 – the year this report was conceived – will graduate from high school in 2030. Those 17 years are likely to be years of immense change. We cannot know what the world will be like when these students graduate, but looking 17 years into the past gives us a clue to the scale of likely transformation.

Back in 1996, the Internet was in its infancy. Almost every telephone was attached to a copper wire. Students got their information from teachers and textbooks, with very few opportunities to interact directly with the world outside the classroom. By 2030, today's opportunities and technologies – its mobile phones and tablet computers – will no doubt seem as outdated as those of 1996 do to us. No one has a good grasp of what 2030 will be like, but if we begin now to build educational systems that are flexible, innovation-friendly and forward-looking, we will be giving future students the best possible opportunity to thrive in their world.

It has already become clear that the 21st century is one of rapid change. That means the type of education a child receives will make an enormous difference to the outcome of their lives. In the very different world of 2030, we can expect that many of the skills and competencies that schools teach today will no longer be as useful as they once were. Many of the students who graduate from high school in 2030 will end up working at jobs that do not even exist today. A report commissioned by the UK government's Department for Business Innovation and Skills suggested that job titles such as "nano-medic" and "vertical farmer" will almost certainly be common currency by 2030.[2] A significant proportion of today's jobs, on the other hand, will be gone forever.

Information will flow even more quickly in 2030 than it does today, and students could have enough computing power at their fingertips to ask – and answer – questions that seem impossible now. This suggests that knowing facts will no longer be a premium skill. Instead of filling their heads with specific knowledge, young adults will need to develop a set of skills and competencies that have largely been excluded from the education systems and curricula of the last century. Students will need to learn how to learn – how to gather and synthesize information from many sources, how to think critically about it, and how to fashion creative responses to problems and challenges. In addition to reading, writing and numeracy, students will need to acquire new literacies such as data visualization and analysis, search literacy and visual literacy.

This is the right time to press forward with this kind of educational transformation. We have the information and experience we need to embrace the proven new means of learning that will equip students with relevant skills and knowledge. This shift will be to everyone's benefit. We can be confident that quality of life will remain connected to education in this new environment. There is an urgent reason to invest in moving away from learning modes that are known to be outdated and move towards those that enable citizens to adapt to rapidly shifting opportunities and pressures. Besides creating happy, thriving, healthy populations, the acquisition of these 21st century skills is likely to create an ever more prosperous world.

The world of 2030 will likely be more aware of inequalities, too. The new ease of communication, travel and business means we have ever-widening contact with what were once remote, disconnected areas of the globe. This provides new opportunities to reduce the disparities between us all. Globalization means that problems affecting one region will have effects on other regions. It also means that solutions to problems can be more widely shared. Since there is no way of knowing where in the world such solutions may be created, it makes sense to implement the new forms of learning as widely as possible. A global upturn in the outcomes of education will have an exponential return on investment. When we equip the whole of humanity with the tools of learning, we do ourselves an enormous favour.

1.   Barber, M, 2014. "A Rich Seam: How New Pedagogies Find Deep Learning."
2.   Talwar, R & Hancock T, 2010. "The Shape of Jobs To Come: Possible New Careers Emerging from Advances in Science and Technology (2010–2030)"

Issues of climate change, and water, energy and food shortages require innovative solutions from thinkers who can synthesize knowledge from, and work across, different disciplines. The generation currently approaching the start of their education will face an even more pressing need to solve these problems. They will thus need to learn how to be creative – or how to retain their innate creativity.

Becoming a lifelong learner also lays the foundation for personal and community well-being and fulfillment. Four of the top five countries in the European Lifelong Learning Index also appear in the top ten European countries on the Average Happiness Index.[3] Educational attainment is positively correlated with good health; statistics suggest that investment in education can reduce long-term healthcare costs.[4]

School systems are criticized for failing to keep students' attention without any concession to allow more engaging material and teaching methods that would remedy the problem.

For all these reasons, we believe this is a good time to implement deep and lasting improvements in the education systems that equip our children for life. The good news is that research, experiment and creative thinking have already begun to provide us with the path to this better learning future.

This report focuses on transforming the secondary school experience, specifically high school for students roughly aged 15–18. We made this choice deliberately – over the last decades,

high school has arguably become a neglected part of the educational endeavor. At one end of the educational timeline, the United Nations states in its Millennium Development Goals that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. In higher education, too, there is no shortage of media and academic discussion. Even though only half of our young people, at best, go on to post-secondary education, concerns over what these institutions should offer, who should pay for the courses, and so on, are rarely out of the news.

In the middle, however, an alarming gap has opened up. Secondary education has been poorly served in terms of focus and support. There is frequent criticism of the current situation and its professionals. There is political wrangling over the content of secondary school curricula, and an unhealthy focus on the results of assessments of its users' abilities. School systems are criticized for failing to keep students' attention without any concession to allow more engaging material and teaching methods that would remedy the problem. That seems especially disingenuous when so many learning professionals – teachers, teacher trainers, and education researchers – have developed interesting, innovative and successful solutions to individual problems.

No one is more aware than those working in the education sector that there is room for improvement. The challenge has always been to identify improvements that can have lasting

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3.   The European Lifelong Learning Index (ELLI) http://www.elli.org/; The Earth Institute, Columbia University, 2012. "First World Happiness Report Launched at the United Nations." http://www.earth.columbia.edu/articles/view/2960

4.   Suojanen, I, 2013. "Happiness Education: The Role of Education in Boosting Happiness." http://www.atiner.gr/papers/EDU2013-0395.pdf

impact and reach a diverse range of students and learning professionals in a feasible manner. In other words, globally appropriate educational transformations must be:

- Affordable in what are frequently impoverished, poorly resourced environments;
- Sustainable with a view to ongoing development so that they will respond and adjust to the demands of a rapidly-changing world;
- Adaptable to the varied requirements that different communities place on the end goals of education; reforms must be designed to flex, taking into account local preferences and ways of doing things;
- Scalable in terms of the availability of adequate resources for widespread implementation. There is no use, for instance, in insisting that every school be staffed with the "best" teachers. Putting aside the questionable practice of ranking teachers, a state or province might be able to create one such school, but to the detriment of other schools, and at a huge cost to most of the students within that jurisdiction. Required non-human resources, whether they be tablet computers or tables and chairs, can also only be recommended on the basis that they do not discriminate between resource-rich and resource-poor communities;
- Implementable in that there has to be a definable path for putting these recommendations into place. Too often, educational utopia has been defined and described without any mention of a viable means of transport to this idyllic location – or indeed a road map to indicate the route.

In 2013, Waterloo Global Science Initiative (WGSI) took on the task of collating and synthesizing the latest research, knowledge and experience in educational reform. To this end, WGSI convened Equinox Summit: Learning 2030. This document is the outgrowth of that summit: a vision for how learning can be improved, and a set of recommendations for immediate implementation. Our Blueprint offers a unique perspective on dealing with the issues of learning at the beginning of the 21st century because of the unique makeup of our collaborators. The Summit assembled a group of educators, education researchers and recent high school graduates for five days in Waterloo, Ontario, Canada. These participants were selected to bring together a group that represented a diverse set of experiences. We feel that aim was achieved. The group that contributed to this report was:

- Geographically diverse, representing all six inhabited continents;
- Diverse in age, with participants as young as 18 years old;
- Diverse in educational experience – some had reached PhD level, others had, through extenuating circumstances,

struggled to attain basic secondary qualifications. Some had "hacked" their own education by accelerating their passage through school, defining their own curriculum, moving themselves to a geographical location that would improve their opportunities or simply leaving school to govern their own learning experience;
- Representative of a range of cultural and socioeconomic backgrounds. Our participants came from small, isolated communities, urban middle class America, rural African communities, ethnic minority groups and everyone in between [See Appendix for more detail];
- Diverse in life and career experience: we had university professors, social entrepreneurs, a restaurant worker, those who had set up high-tech start-up companies, college students, a former music video producer, a research chemist, teacher trainers, and others [full list in Appendix].

This diversity was deliberately brought to bear upon the process of creating a vision of learning in 2030 that would be broadly applicable as well as effective.

Our discussions revealed nine crucial areas to explore, and these provide the focus for the main chapters of this report:

1. Curriculum – the skills and content at the heart of a 21st century education;

2. Pedagogy – methods of learning: creating meaningful learning experiences that allow learners to reach the goals of the curriculum;

3. Teachers – the learning professionals: the role of those who support learning, from where they are drawn, and how they are trained, supported and rewarded;

4. Learning environments – the physical and contextual environment in which learning takes place;

5. Assessment – measurement of progress to inform future learning: what is necessary, who needs to know the outcomes, and how is the measurement best achieved?

6. Organization – oversight and infrastructure of learning environments: the best way to facilitate learning, learners and their supporters and guides;

7. Scalability and global applicability – changes that work for everyone, everywhere;

8. Cost and funding – the answer to the age-old question: is implementing change too expensive?

9. Implementation pathways – how to get there from here.

It is important to emphasize that our recommendations in these nine areas create an interconnected picture of the optimal future of learning. It is not possible to change one aspect (in a scalable way) without introducing changes elsewhere in the system. For that reason, we do not regard our recommendations as a "buffet" where policymakers can pick and choose what they like from a range of options. We are presenting instead a single, coherent vision that constitutes the minimum action necessary to bring about the kind of change necessary to give 21st century high school graduates the best possible start in life.

The Plowden Report emphasizes the individuality of learners and the need to refrain from making unnecessary or premature judgments of their abilities.

We can go back even further, to the Commission on the Reorganization of Secondary Education, an initiative that began in the United States in 1918. The Commission declared that "Education in a democracy, both within and without the school, should develop in each individual the knowledge, interests, ideals, habits, and powers whereby he will find his place and use that place to shape both himself and society toward ever nobler ends."

> We are presenting … a single, coherent vision that constitutes the minimum action necessary to bring about the kind of change necessary to give 21st century high school graduates the best possible start in life.

By and large, jurisdictions have struggled to implement the recommendations of such reports successfully. However, these are ideas whose time has finally come. The group that created this report, consisting of teachers, students, administrators, and education researchers, reached an extraordinary consensus, agreeing that we now have at our fingertips all that is needed to make this vision a reality. Historical challenges are not a barrier to future success, whether in personal learning or in the improvement of an education system. There is much to learn from past struggle, and our chapter on implementation involves thoughtful analyses of what has held back these reforms in the past so as to increase the chances of their full implementation this time around.

Before offering our recommendations in detail, we want to anticipate the objection that we have "seen this all before." There are certainly historical precedents for the recommendations in this report. It could be argued, for instance, that much of what we are presenting can be found in a report published in 1968 by the Provincial Committee on Aims and Objectives of Education in the Schools of Ontario, Canada. The Committee "heard presentations by experts, commissioned research studies, and visited schools, institutions, colleges of education, and universities in several educational jurisdictions. Answers to many problems were found by studying innovations already implemented in the schools of Ontario and other Canadian provinces. The Committee sent teams to study the educational systems and programs in many parts of the United States and in several countries in Europe and [Asia]." The Committee's report included by-now familiar refrains such as "There is increasing evidence that children are often better taught in groups centered around interests, and as individuals, than in classes consisting of 30 or 40 pupils" and "In helping a child learn, teachers and personnel should enjoy teaching, growing, and maturing along with the children."

We could also cite the 1967 "Plowden Report." Though it was a look at the ideal role of primary education in the UK, its conclusions are nevertheless relevant when considering global secondary education. The theme of "At the heart of the educational process lies the child," runs through the Report.

On top of this, there is an urgent need to finally address the weaknesses of education today. The chronic disengagement that sets in at secondary schools across the world is creating social, economic and health problems, and we have yet to find a credible attempt to examine the issue with a holistic perspective, one that steps back and asks whether and how the whole effort could be re-invented to better serve the needs of our society.

Our report is an attempt to do just that. Though our initiative is entitled Learning 2030, it is imperative that the process of transformation begins as soon as possible. The graduates of 2030 are not yet in the education system; it would benefit the world greatly if many of the recommendations have been taken up by the time they are. We hope that you enjoy reading it and that it provides you with the inspiration, tools, and connections to catalyze change in your purview, wherever you are in the world.

Goals

Think

Flexibly
Independently
Continuously
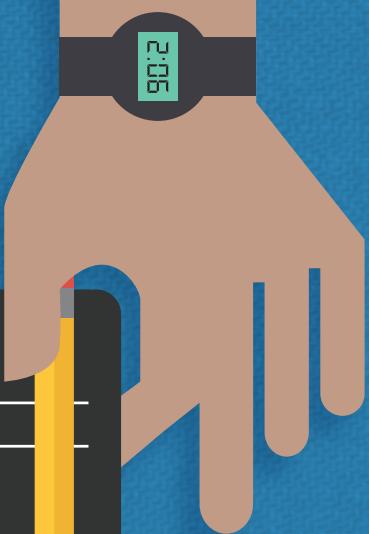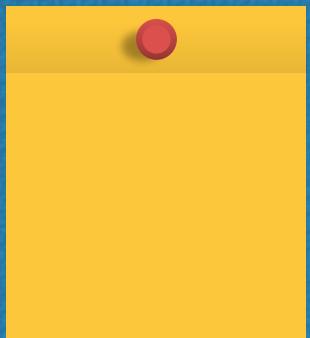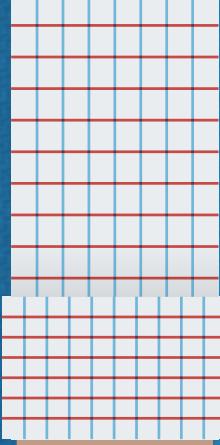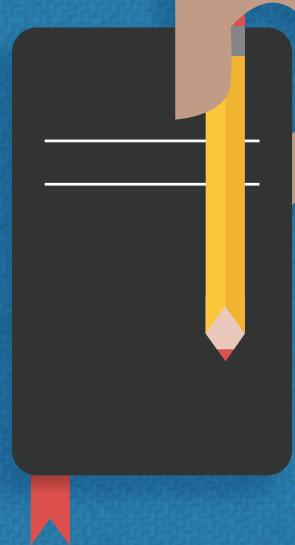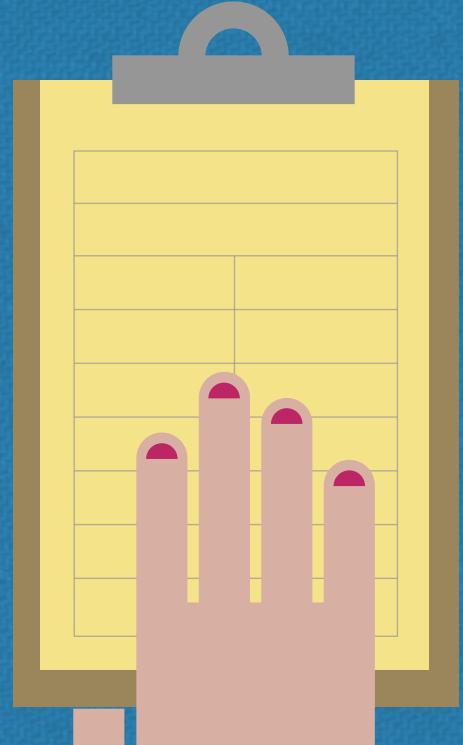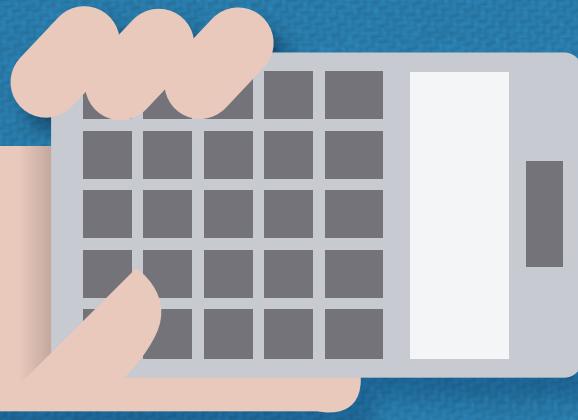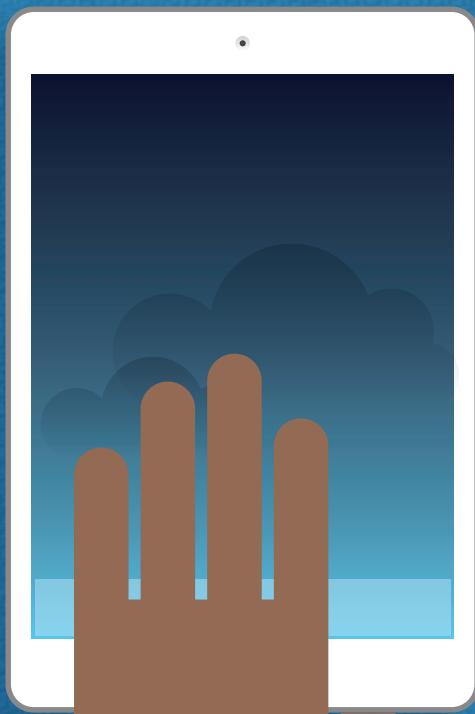
Introduction

Before getting into the nuts and bolts of our new approach, it is worth offering a brief outline of where we are headed. Individual student goals will inevitably differ. Some seek to prepare themselves for higher education. Others may want a solid grounding for entering the workforce, either as employees or as entrepreneurs, and many will want to shift away from academic education in their final years in favour of apprenticeship in a skilled trade. However, despite these different paths, every student should develop the skills needed to play an informed, active role in society and to be part of the solution to the challenges of the 21st century. Those skills include critical thinking, creativity and independence of thought, entrepreneurship, some historical perspective on their own society and others, cultural awareness, and the character traits needed to maintain robust social relationships.[5]

Two concepts are central to creating well-rounded, thriving individuals. One is the notion of the "T-Shaped Learner," who is endowed with a balance of broad knowledge and skills (the horizontal arm of the T) and deep understanding and experience of a few subjects or disciplines (the riser of the T). Our thinking on curriculum, pedagogy and assessment, laid out in the next few chapters, is developed with this in mind. Being T-Shaped is becoming a significant advantage in the workplace and living environment of the 21st century because it provides a combination of excellent communication and collaborative skills, real world experience and ability to innovate, learn and problem-solve.[6]

The second is the concept of Habits of Mind – ways of thinking that enable a learner to thrive throughout life. As Art Costa, Emeritus Professor of Education at California State University, Sacramento (and one of the originators of the concept) says, they are about "knowing how to behave intelligently when you don't know the answer." Establishing these Habits is, in many ways, the most fundamental goal of high school. These traits form the foundation of the education learners will need to prepare themselves for a rapidly changing world. Students who display these habits will be able to respond with confidence, vigor, and resiliency to whatever challenges the future throws at them. Learners should, for example, work on:

- **Persisting** – knowing how to keep pressing on when your inclination is otherwise

- **Managing impulsivity** – acquiring the patience to wait for the optimal moment for action or speech

- **Listening with understanding and empathy** – handling conversation skillfully, getting the best out of others, and becoming a good person to have on the team

- **Thinking flexibly** – knowing how to consider things from a perspective other than your own

- **Thinking about our thinking** – being able to map out your own thought processes – and those of others

- **Striving for accuracy and precision** – employing strategies for checking with others, for instance, to reduce the chances of error

- **Questioning and posing problems** – knowing how to probe and question in order to make topics of study better understood, and learning more satisfying and resilient

- **Applying past knowledge to new situations** – harnessing the lessons of experience, whether your own or that of others

- **Thinking and communicating with clarity and precision** – avoiding vagueness and generalization to enhance impact of thought, speech and writing

- **Gathering data through all senses** – using every source at your disposal

- **Creating, imagining and innovating** – thinking in new ways, maybe about new things, with as few boundaries as possible

- **Responding with wonderment and awe** – using personal passion to intensify learning experiences

- **Taking responsible risks** – rejecting view of failure as a negative to be avoided and encouraging analysis of failure as a necessary step towards refined, improved processes and deeper understanding

- **Finding humor** – using amusing situations as a shared experience for improved communication and the varied perspective of others

- **Thinking interdependently** – deliberately aiming to co-create and share thoughts, programs and experiences with others so as to develop co-operative skills and enjoy group-life

- **Learning continuously** – appreciating that learning happens anytime, anywhere, in any context

With these goals in place, we can lay out our vision for learning in 2030.

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5.   Tony Wagner, co-director of the Change Leadership Group at Harvard Graduate School of Education, has laid out seven "Survival Skills" for the twenty-first century: Critical Thinking and Problem Solving; Collaboration; Agility and Adaptability; Initiative and Entrepreneurialism; Oral and Written Communication; Accessing and Analyzing Information; Curiosity and Imagination.

6.   McMaster, R, 2012. "The T in STEM: The T-Shaped Professional." http://blossoms-newsletter.mit.edu/stem/2012-june/mcmaster.html; See also: Hansen, M, 2010. "IDEO CEO Tim Brown: T-shaped Stars: The Backbone of IDEO's Collaborative Culture." http://bit.ly/1d00lMh for an exploration of T-shaped professionals.

Curriculum

Introduction

One of the key questions to be resolved in any redesign of schooling is the issue of content. What should be the focus of learning during a student's high school education? The answer to this question will play a large part in determining many other aspects of the educational system, including teaching methods, class organization, and school design.

High school education requires a major shift in its focus. Traditionally, the high school curriculum has centred on content, with students expected to learn a prescribed set of facts about an array of specific subjects including sciences, mathematics, and social studies. This approach originated more than a century ago, at a time when governments created "education factories" to train an industrial workforce, and access to information was a primary bottleneck in learning. Students eager to learn had few ways to acquire information apart from their teachers and their school.

The rise of the Internet has radically changed that picture. No longer is there a bottleneck in the delivery of information. Today, knowledge about almost any subject is readily available online to anyone with Internet access – an increasingly large share of the world's population, though not yet everyone. Educational sites such as the Khan Academy, iTunes University, and YouTube channels such as Minute Physics provide clear explanations presented in an orderly sequence by excellent teachers. Digitization of literature, highly effective search engines, and collaborative content creation has made information easy to access, even when subjects are unfamiliar. Moreover, much of that learning happens outside of school, as learners follow their interests. All of this means that students have less need for schools as knowledge transfer centers.

At the same time, advances in our scientific understanding of the learning process itself have given educators a much stronger picture of how students move from "novice" to "expert" in a subject. Learning is not a linear path of acquiring facts and information, but a messy and dynamic process of constructing knowledge, individually and collectively, through exploration and experience.

Indeed, the most crucial part of students' education will be learning not just to find, but to evaluate, synthesize, and employ knowledge efficiently. In particular, they should learn how and why to put their understanding into practice, especially in a global, multicultural context. As Andreas Schleicher, at the time of writing, director of the OECD's Programme for International Student Assessment (PISA) has put it, "the focus is on enabling people to become lifelong learners, to manage complex ways of thinking and complex ways of working."[7]

With this in mind, the high school curriculum should move away from its traditional subject-centred design toward one that emphasizes the development of Habits of Mind, skills and competencies that cut across traditional academic disciplines. As discussed in more detail in Chapter 6, this new learning should take place primarily, but not exclusively, through a series of in-depth, student-led projects. Their content will need to be carefully designed by learners in collaboration with the expert, informed guidance of their teachers to ensure that they meet instructional objectives. The difference, however, is that these instructional objectives should centre on habits, skills, and competencies. The actual subject-matter content of the projects need not conform to rigid guidelines, but can follow the interests of students and the needs of their local community (with caveats discussed in more detail below). In effect, these projects will use content as a delivery system for the skills that form the core of what we wish to teach.

21st century skills

A consensus is rapidly emerging in international opinion about the skills and competencies that a 21st century education should provide to students. Organizations such as the Partnership for 21st Century Skills in the United States, C21 Canada, and the OECD's New Millennium Learners programme are converging on the view that education needs to develop skills such as collaboration, synthesis, innovation, and reasoning.[8,9,10] Such skills prepare graduates to work together in tackling the serious challenges the world is likely to face in coming decades.

Employers, too, increasingly appear to value a particular set of skills when hiring graduates. A 2012 survey of North American employers by Millennium Branding, for example, found that 98% of prospective employers thought communication skills were important or very important in their choice of job applicants.[11] A positive attitude (97%), adaptability to change (92%), and teamwork ability (92%) rated nearly as highly.

7.   Pearson Foundation, "Five Things I've Learned": http://www.thefivethings.org/andreas-schleicher/
8.   Partnership for 21st Century Skills, 2008. "21st Century Skills, Education & Competitiveness: A Resource and Policy Guide." http://www.p21.org/storage/documents/21st_century_skills_education_and_competitiveness_guide.pdf
9.   C21 Canada, 2012. "Shifting Minds." http:// www.c21canada.org/wp-content/.../02/C21-Canada-Shifting_Minds.pdf
10. Centre for Educational Research and Innovation (CERI) - New Millennium Learners: http://www.oecd.org/edu/ceri/centreforeducationalresearchandinnovationceri-newmillenniumlearners.htm
11. Schawbel, D. 2012 "Millennial Branding Student Employment Gap Study." http://millennialbranding.com/2012/05/millennial-branding-student-employment-gap-study/

Employers also often cite the value of employees who are adept at gathering information, evaluating it, making connections between different pieces of information, and then working out a plan of action.

The Millennium survey found that these are the skills employers have the hardest time finding in prospective employees today. A recent OECD study also indicates a rapidly growing demand for complex skills involving communication, critical thinking, and problem solving.[12] These skills are more than just preparation for jobs, though. They are also better preparation for life in general, and valuable tools for those entering post-secondary education.

One of the motives for us in redesigning high school education is to address this gap. A well-rounded student will need to acquire this broad set of basic skills and attitudes that form the spine of our curriculum:

1. **Self-understanding** – self-awareness, self-analysis, self-evaluation; knowledge of one's own biases; independence and individuality; willingness to take an active role in learning;

2. **Systems and design thinking** – obtaining, evaluating, and communicating information; applying knowledge and understanding; pattern recognition; making connections; constructing explanations from evidence; using conceptual and physical models; planning and carrying out investigations; creative and integrative thinking;

3. **Collaboration** – empathy; listening skills; valuing other perspectives; readiness to communicate; understanding group dynamics;

4. **Learning as a process** – learning how to learn; memory and recall; synthesis, conclusions, and evaluation;

5. **Attitude** – risk-taking; resilience; flexibility; comfort with ambiguity; resourcefulness;

6. **Difference-making** – citizenship; enterprise; practical community applications; understanding of social change and innovation;

7. **Informed decision-making** – readiness to research; flexibility; open-mindedness; willingness to question;

8. **Logical reasoning** – mathematical and computational thinking; scientific method; analyzing and interpreting data; problem-solving;

9. **Translating thought into action** – citizenship; initiative and drive; willingness to act as an agent of social change; entrepreneurial spirit; practical community applications.

These nine interlocking sets of skills cover much the same ground as other iterations of 21st century skills, including those cited above, one by the province of Alberta, Canada, and the six C's identified by Michael Fullan as the key 21st century skills that should be at the core of the education system in the province of Ontario, Canada: Character Education, Citizenship, Communication, Critical Thinking and Problem Solving, Collaboration, and Creativity and Imagination.[13,14] These lists and our own represent complementary views from different vantage points of a complex landscape, each view revealing different aspects of the topography. The underlying structure remains the same, however, these skills, together with the "Habits of Mind" we have highlighted in Chapter 4, are the real goal of a successful high school education.

Taken together, these habits and skills give our learners depth of ability which they can apply to whatever tasks and challenges they will face in the rest of their lives. By emphasizing tools rather than particular items of knowledge, our curriculum gives high school graduates the confidence and experience to learn and act in any sphere, even one where they initially lack knowledge. This flexibility is essential in coping with today's rapidly changing world, and it will be even more crucial in the future.

The role of knowledge

The most fundamental goal of a new curriculum should be to allow learners to develop the underlying character traits known as "Habits of Mind." These traits form the foundation of the education needed to prepare learners for a rapidly changing world. Students who display them will, we feel, be able to respond with confidence, vigour, and resiliency to an uncertain future.

12. OECD Education Ministerial Meeting, 2010. "Investing in Human and Social Capital: New Challenges." www.oecd.org/site/edumin10/46253090.pdf

13. Alberta Education. "Competencies for 21st Century Learning." http://education.alberta.ca/teachers/aisi/themes/21-century.aspx

14. Fullan, M, 2013. "Great to Excellent: Launching the Next Phase of Ontario's Education Agenda." http://www.michaelfullan.ca/wp-content/uploads/2013/09/13_Fullan_Great-to-Excellent.pdf

15. CISCO, 2008. "Equipping Every Learner for the 21st Century." http://newsroom.cisco.com/dlls/2008/ekits/Equipping_Every_Learner_for_21st_Century_White_Paper.pdf

It is worth noting that all of the employer preferences in the Millennium Survey mentioned above were for general skills, not for particular content knowledge. Of course, employers also continue to value literacy and numeracy – but these tend to be regarded as prerequisites for entry into the job field, rather than actual criteria for hiring.[15] More extensive content knowledge is often specific to particular jobs and may need to be taught in apprenticeships or specialized employee training. In contrast, the broader skills that are at the heart of our concept of high school education can be applied across most, if not all, contexts.

This does not mean that knowledge is unimportant, however. Even at the high school level, educators can only teach the habits and skills at the core of the curriculum by applying them to particular knowledge. Students must learn something if they are to learn how to learn, how to process information, and how to work together to achieve a goal. However, the precise details of what students learn are not the point. It is far more important that whatever they learn, they do so with depth, rigour, and context. Educational opportunities are lost every time a teacher cuts short a fruitful discussion, project, or other learning activity in order to "get through the material."

Over the course of their schooling, students must also achieve some breadth of knowledge. By building awareness of what kinds of knowledge are out there in the world, students will develop a sense of what categories of knowledge they may wish to pursue in the future, and construct an intellectual framework on which to hang what they learn. We envision our ideal high school graduate as a "T-Shaped" learner, combining the depth of intellectual skills laid out above together with a breadth of subject knowledge.

By the time a learner completes high school, ideally, he or she should have attained core knowledge and a set of competencies that extends more broadly and flexibly than most school curricula today, particularly in areas such as communication, media and information, and finance. These core competencies – the actual knowledge content of our curriculum – are deliberately specified in a very general way, because the particulars of each are likely to vary depending on cultural and social context.

Each country will wish to emphasize its own history, literature, and cultures. However, different cultural contexts are likely to value different knowledge in other areas, as well. For example, "finance" may involve discussion of investment portfolios and retirement planning in North America and Europe, while schools in rural Uganda might place more emphasis on understanding microloans and how to access them. Similarly, technologies for providing clean water and cooking fuel may be a less relevant part of the environmental curriculum in more economically developed regions than in those that lack ubiquitous central utilities.

Conclusion

This approach to the high school curriculum is a logical extension of educational reforms already underway throughout the world. In the US, for example, the Partnership for 21st Century Skills and the Center for Curriculum Redesign advocate for an expansion of curriculum beyond traditional subjects to include newer subjects such as environmental awareness, globalization, and entrepreneurship, in addition to broader skills such as life skills, critical thinking, and collaboration.[16,17] The European Union also identifies key competencies that include communication, learning to learn, and social and civic competences.[18] The UK science curriculum, too, now seeks to develop skills such as teamwork, problem-solving, and information technology, in addition to traditional subject matter.[19]

These changes to curriculum will only be successful in producing the high school graduates we seek if we also make parallel changes in the way we teach, the way we test, the way we train teachers, and the way we design our schools. The next few chapters outline our vision of these changes. We stress once again that these reforms are all part of a single package.

16. Partnership for 21st Century Skills, 2007. www.21stcenturyskills.org
17. Fadel, C, 2011. "Redesigning the Curriculum." White paper, Center for Curriculum Redesign: http://curriculumredesign.org/wp-content/uploads/CCR-Foundational-Whitepaper-Charles-Fadel2.pdf
18. European Commission, Education & Culture. http://ec.europa.eu/dgs/education_culture/publ/pdf/ll-learning/keycomp_en.pdf
19. National Curriculum of the UK: https://www.gov.uk/government/collections/national-curriculum#curriculum-by-key-stages

Pedagogy

Broad Social Impact
in the School

Develop and Refining
Habits of Mind

Appealing to
Curiosity

Filling
Needs
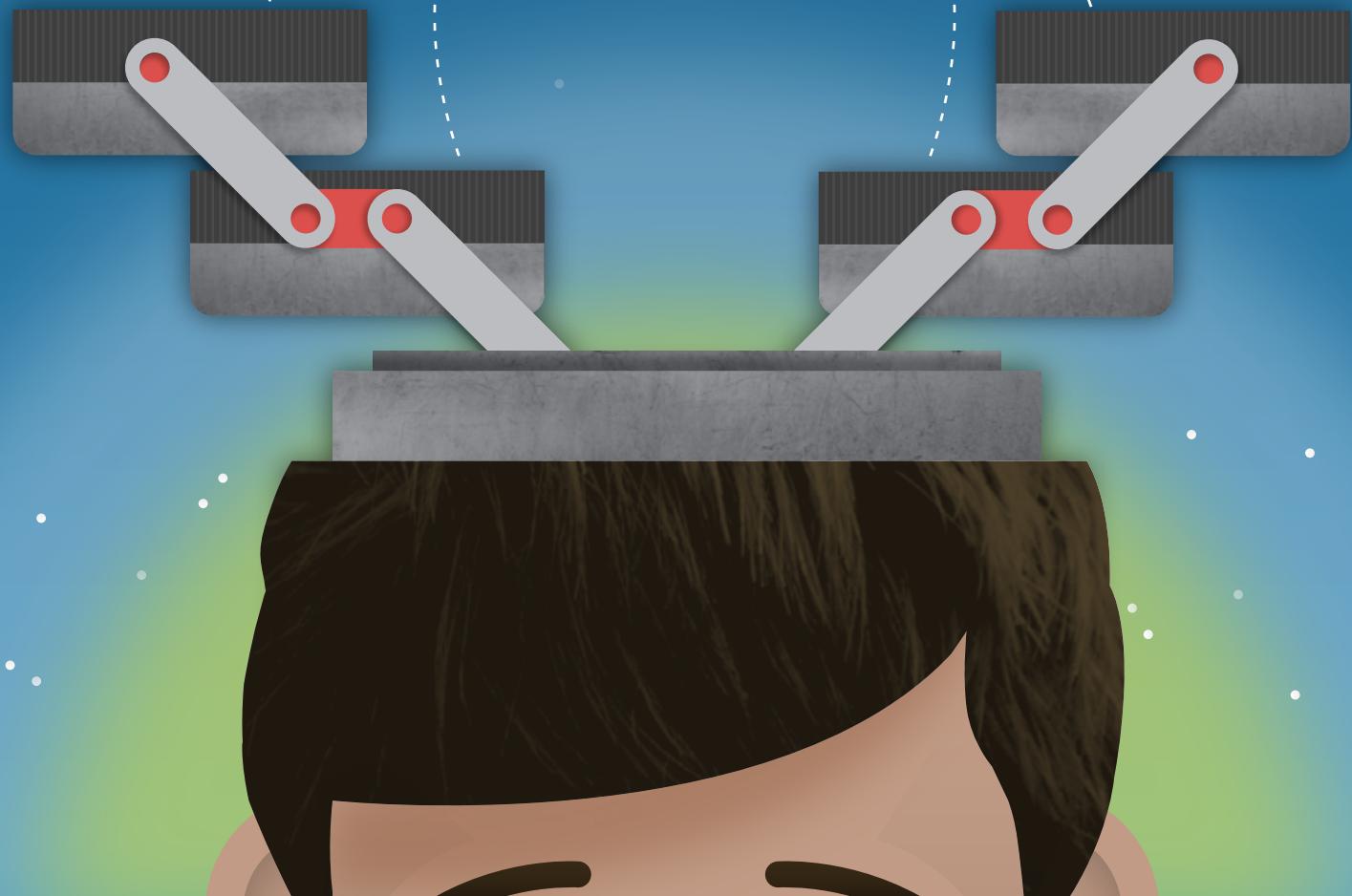
Introduction

Chapter 2 outlines a move away from the mindset that the main task of education is to convey a predetermined body of knowledge. Instead, we propose a curriculum that focuses on helping learners acquire a set of broadly applicable skills and Habits of Mind that they can apply flexibly to whatever challenges they might face in their later lives and careers. Students' high school years should principally be about learning how to learn and acquiring the competencies they need in order to do that effectively.

This change in focus puts emphasis on the learning process itself. The process is no longer just a means of acquiring information; instead, it becomes the endpoint in its own right. As a result, teaching and learning methods – which have always been an important consideration in education – become more important than ever. This chapter sets out guidelines for the practices in teaching and learning methods that are likely to be most effective at achieving our goal of creating agile, creative, self-motivated lifelong learners.

No document should prescribe teaching methods in exact detail, of course, because no single method will work best in every circumstance. The learning process is complex and variable; research has just begun to scratch the surface of the question of what methods will help students learn most effectively.[20] It seems clear, though, that different methods have different strengths and weaknesses, especially when taking into account the preferred learning styles of individual learners. Different methods will also be optimal in different cultural contexts. Some methods will be better at conveying facts; others at fostering creative thought. Some will work for the most academically advanced students; others may be superior for those who need more guidance and support. Alert teachers will be able to employ different learning methods as the situation dictates, and modify their approach continually depending on their results (discussed more fully in Chapter 6: Assessment).

Instruction centred around collaborative projects

High school learners should spend most of their schooling engaged in a series of in-depth inquiry projects, undertaken individually or, more often, in groups. This approach stands out from the rich diversity of pedagogical methods in fostering the skills we seek to develop in the learners of 2030, because

it favours the "how" of learning rather than the "what." This makes it an ideal fit for a new curriculum that emphasizes skills rather than factual knowledge, as outlined in Chapter 5. Other instructional methods may be used as appropriate to support this project-based focus.

Why projects?

Learning through collaborative projects places learners in realistic situations that draw on a much richer set of skills than conventional lessons do.[21] This major advantage has led several education groups to advocate this approach to learning. The Buck Institute for Education, for example, points out that:

"To answer a Driving Question and create high-quality work, students need to do much more than remember information. They need to use higher-order thinking skills and learn to work as a team. They must listen to others and make their own ideas clear when speaking, be able to read a variety of material, write or otherwise express themselves in various modes, and make effective presentations."[22]

The project-based approach has other advantages, as well, they note:

- Students begin with a real-world problem of interest to them. This provides both context and motivation for them to learn the concepts and skills they need to address the problem.

- The project format pushes students to take the initiative to identify what they need to know, and then go out and find the information.

- Over the course of a long-term project, students gain experience at giving and receiving feedback, reflecting on this feedback, and revising their project.

- The project leads to a definite outcome, a new idea, action, or object that is the product of students' effort.

- Students learn to present this product to a public audience, gaining valuable experience at public speaking and the arts of presentation. The knowledge that they will present their results in public helps motivate students to do their best work.

20.   Koedinger K et al, 2013. "Using Data-Driven Discovery of Better Student Models to Improve Student Learning."
21.   For a discussion of the benefits of collaboration, see Clive Thompson, 2013. Smarter Than You Think (Penguin), p 194
22.   Buck Institute for Education. "What is Project Based Learning (PBL)." http://www.bie.org/about/what_is_pbl

One of the great strengths of project-based learning is that students must learn to deal with uncertainty and ambiguity. This is one of the essential 21st century skills that many observers have highlighted, and one that is not often taught well today. Well-chosen projects pose open-ended questions whose answers are not fully known, either because the underlying principles have not been worked out yet, or because they have not yet been applied in a particular context.[23] As a result, when learners embark upon a project, they do not know precisely where their efforts will lead them. This forces them to learn to "founder intelligently", as one Equinox Summit participant put it, suggesting and testing possibilities as they move closer to solutions that work. This contributes directly to developing the Habits of Mind outlined in Chapter 1, and in particular the habit of treating failure as a step in the learning process and an opportunity for learning and growth.

Learning through projects also shifts the role of the teacher from that of dispenser of information to that of mentor or guide. In this way, responsibility for learning shifts from teacher to learner as well. Chapter 4 discusses this shift in more detail.

To see how this project-centred approach might work in practice, we now present a suggestion of how such learning might happen.

An example of workflow in project-centred learning

Typically, students might begin their day with a roundtable discussion among group members. This discussion, usually facilitated by a teacher, reviews progress on their project and lays out goals for the day. Students then work on their assigned task(s) for the rest of the day, either singly or in groups as appropriate. If a student is involved in multiple projects at the same time, each project will claim part of the day as required.

The exact nature of a student's work will, of course, vary depending on the needs of the particular project. However, a well-chosen project will require learners to research context, gather specific pieces of information with increasing depth and sophistication, present them to the group, integrate information provided by different group members, discuss and debate the importance of different points of view, design practical solutions, and present these solutions to others outside the project. If the project is well chosen, these solutions are likely to be relevant to the learners' community and may actually be implemented in the real world, adding a further level of significance to the project.

During the course of work on a project, students may occasionally identify missing skills or information – things they do not yet know but need to. For example, students working on a project that involves understanding which tree species grow where may find that they need to know whether the distributions of two tree species actually differ. This will lead to a discussion of ways to compare two distributions, and thus identify a need to learn some statistics.

When such a need arises, students can either learn the material on their own (often from prepackaged instruction available on the Internet) or "contract out" for the information, asking for guidance from a teacher, another student, or even an outside expert. Some students are likely to develop significant expertise in particular fields – for example, in construction techniques, database management, computer-aided design, or entomology – that other groups may draw on repeatedly. This helps build confidence and capability in the student-experts and a sense of collegiality among the entire learning community. By the end of their high school years, learners should have had experience both as experts and as someone in need of an expert. This helps reinforce the notion that these roles are fluid over time, and that everyone both has expertise to offer and has need of others' expertise.

This approach makes the crucial assumption that high school learners have enough awareness and initiative to take ownership of their own learning process, and that they do not need to be under the direction and control of a teacher at all times. Examples where this is already happening, such as the Independent Project, begun at Monument Mountain Regional High School in Massachusetts, US and the Sudbury Schools in several countries testify that this assumption is a reasonable one.[24,25]

23. Edutopia. "Project-Based Learning Research Review: Evidence-Based Components of Success." http://www.edutopia.org/pbl-research-evidence-based-components

24. Levin, S, 2011. "The Independent Project" White Paper. http://www.theindependentproject.org/the-white-paper/

25. Sudbury Valley School. http://www.sudval.org/

26. Shad Valley. http://www.shad.ca

27. Nobori, M. "What Makes Project-Based Learning a Success?." http://www.edutopia.org/stw-project-based-learning-best-practices-new-tech-high-school#more|What

28. Dickinson, A, 2013. "Re-Imagining the Comprehensive High School." http://www.edutopia.org/blog/sammamish-1-comprehensive-high-school-adrienne-curtis

Project-based learning has a strong record of success as an enrichment to education.

One notable example is Canada's Shad Valley program. This award-winning program, which has been operating for more than 30 years, places high-achieving high school students in a month-long immersion on a university campus, where they undertake major projects, often involving design and prototyping of inventions. In the process, students learn to collaborate, seek out information, fail productively, and test their own ideas. Shad Valley's success is evident in its high standards for admission. Many participants regard the Shad experience as the high point of their high school learning.[26]

Shad Valley draws on the best students nationwide for its programs. It is not surprising, therefore, that these students succeed in drawing a rich experience from the projects they undertake. However, other examples show that even average students find projects of this sort to be engaging, instructive experiences that lead to successful outcomes. Manor New Technology High School, a public high school near Austin, Texas, US, for example, offers exclusively project-based instruction. Most of its students come from families that have never attended university, yet 98% of Manor students graduate, and every graduating student is accepted to university.[27] Similarly, Sammamish High School in Bellevue, Washington, US, is shifting to a curriculum built entirely around collaborative projects with good success, even though a high proportion of its students come from disadvantaged backgrounds.[28]

Examples of successes with project-based learning

The University of Qatar offers an enrichment program called Al-Bairaq that is open to high school students of any academic standing.[29] Participants engage in projects in materials science, engineering, and other sciences, under the guidance of researchers at the University. At the conclusion of their program, the participants prepare and present their results to an audience drawn from the community. Each year, some of the strongest presentations come from students seen as "average" performers in traditional exam-based courses. This achievement of project-based learning is particularly impressive, as one of our central goals is to ensure that groups that have been badly served by current learning models are given tools that allow them to achieve their full potential.

Comparing project-based learning to conventional approaches

Few studies have directly compared the outcomes of project-based learning against more conventional approaches for entire courses of study.[30] The limited evidence so far, though, suggests that students flourish, performing at least as well as their more conventionally taught peers, if not better. For example, students who took a US Government and Politics class built around 5 in-depth projects were compared against students who took a conventional, lecture-based course from the same teachers. The students who learned via projects proved better than their conventionally-taught peers at the real world skills of understanding and influencing public policy.[31]

A literature review by Strobel and van Barneveld concluded that problem-based learning, a similar approach to project-based learning, led to better skill development and long-term retention than conventional approaches.[32] It also produced greater satisfaction in both teachers and students – an indication of higher engagement.

A particularly impressive, and somewhat counter-intuitive, outcome of the project-based approach is that it does not seem to leave students with "holes" in their education. Though they engage in relatively few project topics, and thus might reasonably be expected to miss out on knowledge covered by a broader approach, research suggests this does not happen.

29. Al-Bairaq World, Qatar University. http://www.qu.edu.qa/offices/research/CAM/dmsprogram/index.php

30. Mergendoller, J. R. , Maxwell, N. L. , & Bellisimo, Y., 2006. "The Effectiveness of Problem-Based Instruction: A Comparative Study of Instructional Methods and Student Characteristics." Interdisciplinary Journal of Problem-based Learning, 1(2). Available at: http://dx.doi.org/10.7771/1541-5015.1026

31. Parker, W. C., Mosborg, S., Bransford, J. D., Vye, N. J., Wilkerson, J., & Abbott, R., 2011. "Rethinking Advanced High School Coursework: Tacking the Depth/Breadth Problem in AP U.S. Government and Politics." Journal of Curriculum Studies, 43:4 (2011): 533-559.

32. Strobel, J. , & van Barneveld, A., 2009. "When is PBL More Effective? A Meta-synthesis of Meta-analyses Comparing PBL to Conventional Classrooms." Interdisciplinary Journal of Problem-based Learning, 3(1). Available at: http://dx.doi.org/10.7771/1541-5015.1046

US Government students who used project-based learning, for example, scored just as well on a standardized Advanced Placement test – that is, they knew just as much material – as students who took the lecture-based course.[33] It seems reasonable to expect that, as experience and expertise in delivering project-based learning grows, this method will begin to outstrip the results gained through more traditional methods.

Project selection

Learning is most effective when learners care about the subject.[34] Therefore, topics for projects should be selected by the learning partners – that is, students and learning professionals should develop the scope of the projects together. Where possible, the topics should be of practical relevance to the students' lives and communities. Students are likely to select a range of projects throughout the year that they find attractive for any of several, perhaps overlapping, reasons.

Possibilities include:

- Projects of Interest – appeal to students' sense of curiosity or eagerness to acquire new skills (e.g., a science experiment, learning a musical instrument, or writing software)

- Projects of Importance – have broader social impact in the school, community, or world (e.g., gathering and distributing food to needy families, or lobbying for social change)

- Projects of Discipline – develop or refine Habits of Mind (e.g., deepening understanding of mathematics, learning to work like a writer or editor, or learning to think like a scientist)

- Projects of Consultancy – fill needs of local businesses (e.g., designing software for a nonprofit, writing training manual for a new product)

To get maximum value from any project, it must be challenging yet within students' capabilities, and it should demand a rich set of new knowledge. Therefore, significant input and guidance from teachers and other learning professionals will be crucial in helping students choose high-quality projects. In particular, teachers will be responsible for helping students develop projects that test and expand students' repertoire of skills and knowledge, avoiding closed-ended projects with trivial answers and "safe"

projects that merely rework familiar ground. Teachers and other learning professionals, as well as outside mentors, are in a good position to help students broaden projects to consider new dimensions that the students may not have been aware of initially. Students searching for projects of importance or projects of consultancy should also be encouraged to seek guidance from relevant members of the larger community, including peers who have embarked on similar projects. The process of project selection and design is treated in more detail elsewhere.[35]

To add further depth and engagement to students' learning, each year's projects could be built around a broad theme. Examples might include "water," "growth," or "equality," or "change." This allows for overlap and synergy between the several projects that each student is involved with over the course of the year, and between the projects of different groups. It also serves to build community among the learners and connect them to their broader community in a way that a series of unrelated projects would not. Schools may choose to have the learners who will graduate at the end of the coming year select the theme for that year's projects. This allows the year's theme to most fully reflect the interests of the most senior and most experienced students, serving as a capstone to their high school years and giving them the opportunity to present themselves to the post-secondary world in a way that reflects their own priorities.

Other pedagogies

We regard our project-based approach as the organizing principle for high school education. It provides an umbrella under which teachers can easily include other pedagogies whenever required. In essence, the project framework provides the big picture, motivating learners to acquire particular pieces of knowledge. Once they have identified a knowledge objective, learners and their teachers can work together to determine the best way to attain that objective. Sometimes the most effective way to do this may be simply to have the teacher present a lecture. However, most of the time, learning should be student-centered, where the students direct the learning – both individually and in groups – with support from the educator. We know that students learn best when they are engaged in meaningful experiences that are aligned to their ability and that challenge them to construct

33. Parker, W. C., Mosborg, S., Bransford, J. D., Vye, N. J., Wilkerson, J., & Abbott, R., 2011. "Rethinking Advanced High School Coursework: Tacking the Depth/Breadth Problem in AP U.S. Government and Politics." Journal of Curriculum Studies, 43:4 (2011): 533-559.

34. According to Richard D. Jones of the International Center for Leadership in Education, "Students invest more of themselves, work harder, and learn better when the topic is interesting and connected to something that they already know." Strengthening Student Engagement, November 2008.

35. Enquiring Minds: http://www.enquiringminds.org.uk/; Edutopia. "Project-Based Learning Research Review: Evidence-Based Components of Success." http://www.edutopia.org/pbl-research-evidence-based-components

By shortening the feedback cycle and making it easier for teachers to pool their experiments and compare notes, technology can dramatically reduce the cost of failure and encourage innovation.

their own understanding.[36] This type of learning is non-linear, with exploration, play and "safe failure" as key components. All of these approaches, and others, are compatible with the basic structure of the projects.

This allows for a great deal of flexibility in instructional methods. Attentive teachers and self-aware students can tailor each group's methodology to the particular strengths and learning styles of its members and the needs of the moment, adopting whatever method seems most appropriate. Indeed, groups may sometimes choose to experiment with different learning styles, which gives learners a broader exposure to ways of learning and improves self-awareness of their own strengths and weaknesses. This flexibility is a major strength of our approach.

A note on the role of technology

Technology is a valuable part of education, and schools should embrace it to the extent they can. In a wired classroom – or a wired home, for learning outside of school – students have instant access to information on whatever topic is most relevant to their needs of the moment. Through online resources such as Khan Academy, Coursera, and iTunes University, they can view and review lessons presented by exceptional teachers at their own pace using the power of "pause" and "rewind." They can reach out to ask questions of experts outside the walls of their school, or collaborate with learners elsewhere in the

world to address problems in a global context. Educational games such as Making History and the Radix Endeavor provide structured immersive worlds in which learners can explore the complexities and dynamics of world history and science/technology/math, respectively.[37,38] Such games offer learning experiences that would not be possible in real life and provide an opportunity for learners to engage deeply in concepts in new ways.

The effective use of technology has less obvious payoffs in the classroom, too. Games and online review modules can provide rapid, individualized feedback to teachers about each learner's progress, particularly with the emerging power of learning analytics. They can identify which concepts need additional work, either through additional online modules or through direct, one-on-one sessions with the teacher or another learning coach. Researchers are also developing technologies that can monitor each learner's attentiveness through the course of the day, which gives teachers immediate feedback about what holds students' attention and what does not. This lets teachers assess and abandon ineffective experiments quickly – a crucial step in fostering a culture of trial-and-error innovation. At a larger scale, Internet applications can help teachers pool the results of their experiments across many different classes, schools, and even countries. This, too, can speed up the innovation process through collaboration. Too often, teachers are reluctant to experiment because by the time exam scores reveal that an approach has not worked, students have lost valuable weeks or months of learning.

36. OECD, 2010. "The Nature of Learning: Using Research to Inspire Practice." DOI: 10.1787/9789264086487-en
37. Making Histiory: http://making-history.com/
38. The Radix Endeavor: http://www.radixendeavor.org/
39. Kagire, E, 2013. "Rwanda to Roll Out LTE Network." http://www.theeastafrican.co.ke/news/Rwanda-scores-another-first-in-region-with-4G-rollout/-/2558/2048140/-/fildg1z/-/index.html
40. Davis, J, 2013. "How a Radical New Teaching Method Could Unleash a Generation of Geniuses." http://www.wired.com/business/2013/10/free-thinkers/all/

By shortening the feedback cycle and making it easier for teachers to pool their experiments and compare notes, technology can dramatically reduce the cost of failure and encourage innovation.

Despite these many benefits that accrue to technology, we are also aware that for many schools, especially those in less developed countries, there is not enough money or access to make full use of technology. Indeed, some rural regions may lack reliable Internet access entirely. This problem is likely to diminish over time, as infrastructure improves. Rwanda, for example, expects to have nationwide high-speed Internet available nationwide for cellular phones within three years.[39]

As communications technology and infrastructure become more widely available, even the poorest schools may be able to add technology to their repertoire, even if it is only shared Internet access over a single cell phone or computer. This gives students an opportunity to seek out their own information just as students in wealthier schools can. No matter how limited or rudimentary the technology, it is still of educational value. Examples such as José Urbina López Primary School in Mexico show how schools can use technology sparingly to great effect.[40] International aid should also support poorer countries in harnessing the power of technology for learning.

The great value of a project-based approach is that it does not hinge on technological support. Students can still draw on knowledge from teachers, fellow students, and other members of the community. Projects are likely to be more locally focused in this case and can yield real community benefits, particularly when other resources for community improvement are limited.

Conclusion

High school learning should take place mostly within the context of in-depth projects on topics of relevance to the learners and their local community. In the course of completing a project, learners will have to identify what they need to learn, learn it, discuss and integrate their findings, draw conclusions, and present their results, all in a collaborative setting. These diverse demands help students develop a wide range of essential skills, as well as the flexibility to apply those skills in new contexts.

This change in the focus of education from information transfer to project-based inquiry will require significant changes in the role of teachers within the classroom, as discussed in the next chapter.

Teachers
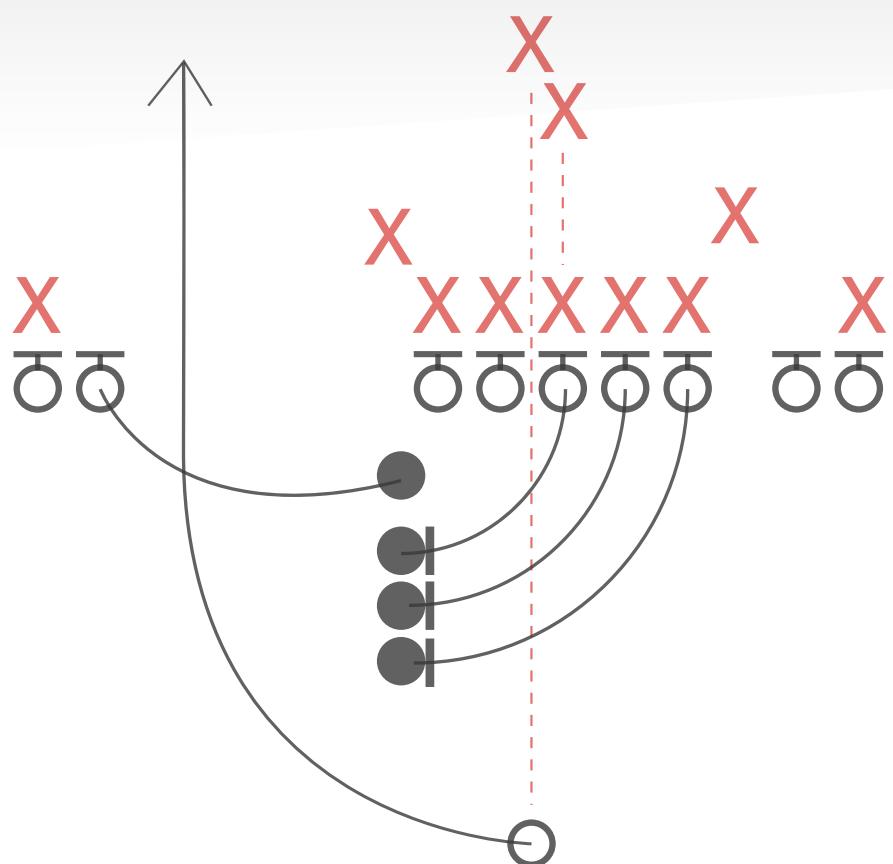
Introduction

High-quality teachers are a crucial part of a good education.[41] Caring, capable teachers understand their students' individual strengths and needs, and can tailor their guidance accordingly, giving each student the direction, motivation, and instruction they need in order to succeed. This will continue to be true under our vision for education in 2030.

However, teachers' roles will need to change in response to the other changes we propose to the educational system. As the high school curriculum moves away from a fixed set of factual content toward a more flexible set of project-based studies, teachers will less often be in the position of knowing ahead of time what students will learn. Instead, they will become co-discoverers with their students. Even today, teachers engage in much less "chalk and talk" than they once did; in the future, though it will not disappear entirely, they are likely to spend even less time at this activity. Sometimes a concise explanation from a knowledgeable teacher will still be exactly what learners want and need at a particular stage in their learning journey.

As teachers spend less time in the role of information providers, they will spend correspondingly more in other, equally crucial roles as learning coaches, learning role models, and researchers. We will briefly discuss each of these roles in turn.

TEACHER ROLES

Teachers as learning coaches

The essence of a teacher's job is to support, assist, and encourage students in the process of learning. In the high schools that we envision, this will not often involve simply giving information to the learners for them to memorize. Instead, teachers will invest most of their time and energy in creating the optimal conditions in which students can do their own learning. This is a subtle, but important, shift that is already taking place in many classrooms, but which should become the norm.

In essence, teachers will be taking on some of the same challenges as coaches of elite athletes. Athletic coaches need not just a deep understanding of their sport, but – perhaps more important – a knowledge of how to motivate their athletes to commit to the persistent, hard work needed to succeed. Similarly, teachers will need to understand the goals and aspirations of each of their students as individuals, and will need to help them develop the resiliency they will need to overcome the obstacles that arise in every learning endeavour. Indeed, this persistence in the face of difficulty is itself an important goal of learning, and a teacher must build this in every student. Only then can teachers apply their expert knowledge of the learning process to coax the most from each of their students.

Each learner should have a specific teacher who serves as his or her "learning coach" during the high school years. Learner and coach should meet one on one at the beginning of the school year to establish individual learning goals for the year, and prepare a study plan to attain those goals. Learner and coach will then meet periodically during the school year to review the learner's progress and refine goals and plan as need dictates. Lumiar School in Sao Paulo, Brazil, already uses teachers primarily as experts in the art of learning, and brings in community members to serve as content experts.[42]

Many school systems already require detailed individual study plans for gifted students and for special-needs students. Every student should have such a plan and, crucially, that student should have a leading voice in setting the goals and creating the plan. Indeed, high school students should take most of the responsibility for generating their plan under the teacher/mentor's guidance. This coaching/mentorship system gives every learner an advocate within the system – an adult who cares about the student as an individual with unique interests, abilities, and ambitions. All students will benefit from having such an advocate, but it will be especially important for those who lack a stable, supportive home environment.

41. We recognize that the education ecosystem contains other learning professionals in addition to those formally trained as teachers: teachers' aides, librarians, computer technicians, and others. All of these members of the school community serve essential roles, though each differs in their precise responsibilities. For convenience, we will usually refer to all these professionals as "teachers," making distinctions only as necessary. We are also aware that there is some resistance to the use of the term "teacher" in our new educational system, because it implies an old-fashioned reliance on one-directional information transfer that we no longer endorse. We will, however, continue referring to educational professionals as teachers, with the understanding that their role in the classroom is changing.
42. Luminar: http://lumiar.org.br/?lang=en; see also "Microsoft Innovative Schools Program Year 1 Evaluation Report," 2009, p 32.

Teachers as role models

The best teachers have always been role models for their students: caring, supportive, open, and enthusiastic. As high school education moves away from standardized knowledge toward a more open-ended exploration through projects, teachers will have the opportunity to model another very important role: that of an active learner.

In the standard school system of today, this opportunity is not easily available. Usually, teachers come into class already knowing the material to be covered, so students rarely get to watch them in the process of discovery and learning. Under our model of learning for 2030, on the other hand, teachers will often find themselves facing questions to which they do not yet know the answers, and even addressing whole subjects they know little about.

This is a strength, not a weakness, of this approach to learning, because students will have the opportunity to see how experienced learners – their teachers – handle the process of gaining new knowledge and skills. They can watch as teachers demonstrate that good learning is always difficult, full of trial and error and blind alleys. Teachers can show by example that persistence and a positive attitude – what psychologist Angela Lee Duckworth refers to as "grit" – are key components of success. Learners can participate with their teachers, in the process of formulating hypotheses, testing them, and making new hypotheses that fit the data better.[43]

Throughout this process – indeed, throughout the entire educational system – educators should encourage learners to treat learning as a set of skills to be developed gradually. Learners are engaged in a long-term process of developing their "learning muscles." Teachers should continually stress that students can improve their learning skills, and they should be explicit about the skills that are being developed by particular classroom exercises. When teachers model learning as something to be built over time, like an athletic skill, this helps students focus on the process, and on their own progress, rather than treating education as a race to a fixed goal line. This parallels Carol Dweck's "growth mindset" – an important contributor to success.[44]

In their lives after high school, learners will often find themselves needing to start from the beginning in learning a new subject or set of skills without a knowledgeable guide to lead them. They will be better equipped for this challenge by being able to draw on the example of their teachers.

This is not to say that background knowledge is unimportant. A good teacher should still have a deep understanding of and passion for some particular field of knowledge. Precisely what that field is may vary depending on the individual teacher and the social context: farming techniques, perhaps, for a part-time teacher in rural Tanzania or software design for a teacher in Singapore or Silicon Valley. Students may not choose to develop their own depth in these same subjects, but they will see how their teachers create, maintain, and use their expertise. The students can use this as an example as they develop their own expertise.

Teachers as researchers

One area in which every teacher should develop expertise is the subject of learning itself. As part of that process, we recommend that teachers be strongly encouraged to experiment with innovative teaching methods, topics, and resources. The ideal teacher should be the educational equivalent of the clinical researchers who apply basic medical research to find better treatments for patients. In a similar way, teachers are perfectly positioned to translate research on teaching, learning, and cognitive science into the classroom.

Forward-thinking principals are already encouraging teachers to do this in some schools, of course. At Ngee Ann Secondary School in Singapore, for example, principal Adrian Lim (an Equinox Summit participant) encourages his teachers to interact often with faculty at teacher-training schools who suggest ideas in need of testing. The teachers do the tests as small-scale research projects in their classrooms, and more than half of the teachers have presented their results at international education conferences. Teachers meet regularly for "Fail-forward Fridays," where they share results, discuss their successes and failures, and plan ways to improve the next time.

43.   Perkins-Gough, D, 2013." The Significance of Grit: A Conversation With Angela Lee Duckworth." Educational Leadership, vol 71, p 14
44.   Dweck, C, 2006. Mindset: The New Psychology of Success. Ballantine Books

High schools should strive to make this "innovation by design" the norm. This will pay off in more effective teaching techniques, in ensuring engaged teachers equipped with the latest knowledge, and in enhancing the atmosphere of learning that should be the lifeblood of every school.

Selection and training of teachers

The kind of education we envision calls for teachers who are caring, empathetic, intellectually nimble, enthusiastic, persistent, and skilled at getting the best from their students. These are precisely the qualities already displayed by many excellent teachers around the world and they will be even more essential in the future.

To ensure a continued, or even enhanced, supply of high-quality teachers for our schools, we recommend thatevery jurisdiction review and update their teacher-training practices and selection policies, responding to the findings of research into what is working best in current systems. In particular, we recommend that teacher-training programs should draw on candidates who have strong academic records combined with a proven set of skills and aptitudes. To the greatest extent possible, all high school teachers should have a university degree in an academic subject in addition to training in education. This content knowledge provides them with depth of understanding that students can draw on during their projects, and serves as a base from which teachers and students can launch further explorations. It also demonstrates a proven facility with project-based study, research and persistence skills, putting the teacher in a good position to facilitate the development of those skills in students.

We note that Finland already requires high school teachers to have a master's degree in an academic subject, in addition to specialized training in education.[45] Singapore is now moving toward a similar system, with two-thirds of incoming teachers now having a master's degree in education to supplement an undergraduate content degree.[46]

This move will enhance the status of the teacher, an important aim of a successful education system. It is worth noting that some societies already regard teaching as a high-status profession that attracts the best and brightest young people. In Finland, for example, teachers have the same social prestige as doctors, and teaching was the top-rated profession in a survey of college students, despite paying only average salaries. As a result, Finnish teacher-training programs can be highly selective, requiring not just excellent grades but also strong personal skills and a commitment to teaching.[47] Singapore's education system similarly recruits candidates from the top third of potential applicants.[48] In both places, this selectivity is regarded as one reason the educational systems are so successful.[49] As teachers gain more autonomy and all learning partners become more engaged in the learning process, teaching should become a more desirable career, allowing all educational systems to become more selective in teacher recruitment.

Finally, all school systems should pay close attention to continuing education for teachers. For example, teachers just entering the profession might be paired with more senior ones. Such pairing can have benefits for both parties, with the senior teacher mentoring the junior in classroom techniques and the junior helping the senior stay up to date in technology and educational research.

Another powerful way to enhance teachers' continued development is to provide opportunities for networking, particularly online, with other teachers facing similar challenges, so that they can share best practices and research results as they learn. Some such forums already exist, such as WIDE world at Harvard University's Graduate School of Education and Pedagogy Unbound, although the latter is focused on college teaching. We encourage school systems, teachers' organizations, and third-party developers to produce better systems that are easier to navigate and more effective for teachers' needs.[50,51]

45. Darling-Hammond, L & Rothman, R, 2011. "Teacher and Leader Effectiveness in High-Performing Education Systems"
46. Ibid.
47. Sahlberg 2011 in Darling-Hammond, L & Rothman, R, 2011. "Teacher and Leader Effectiveness In High-Performing Education Systems," p 14
48. Choo and Darling-Hammond, 2011 in Darling-Hammond, L & Rothman, R, 2011. "Teacher and Leader Effectiveness In High-Performing Education Systems," p 34
49. Darling-Hammond, L & Rothman, R, 2011. "Teacher and Leader Effectiveness In High-Performing Education Systems"
50. Wide World, Harvard Graduate School of Education. https://learnweb.harvard.edu/wide/en/about/whoweare.html
51. Pedagogy Unbound: http://www.pedagogyunbound.com/

Learning Environments

Introduction

The major changes discussed earlier in the way we educate high school learners will require matching changes in the nature of "school" itself. Today, for almost every learner, school is a specific building to which they report during rigidly set hours to meet in assigned rooms in fixed groupings of same-aged peers. When the school day ends, learners leave the building. Most will regard their learning as done for the day, except for assigned homework.

This rigidity of schedule, and the clear demarcation between learning and the rest of life, needs to change. The key principle underlying this change is flexibility. A more flexible approach to learning will transform schools from tightly scheduled hierarchies into much looser and more mobile groupings of learners. In an education system centred around in-depth projects, learning will spill out beyond the walls of the school, empowering learners to take advantage of learning opportunities wherever and whenever the occasion arises.

In the sections that follow, we will discuss in more detail our vision of greater flexibility in student groupings, in learning spaces, in school schedules, and in out-of-school learning. We also discuss the related issue of the expanded role that schools can play in the broader community, as a cultural focal point and centre for the life-long learning we seek to foster.

Flexibility of groupings

As outlined in Chapter 3, high school learning should happen mostly in the context of in-depth projects addressing topics of student interest and local community need. Each project offers a unique set of learning opportunities and draw on a unique set of skills and interests. As a result, every project is likely to involve a different collection of students.

Often, these groups will involve learners of different ages and abilities. This allows learners to experience a diversity of roles within the groups they participate in. Sometimes, especially during the early high school years, a learner will follow the lead of others, taking on tasks that support someone else's plan. At other times, especially later in a learner's high school career or for topics of particular interest or ability, a student will help lead the group and direct its efforts. This reinforces the useful life lesson that roles change throughout life according to context.

Note that we are directing our proposals specifically at high school education. Thus, "mixed-age" groups will involve students who differ in age by only a few years. Mixed-age groups spanning a wider range of ages, such as 6–18, would pose a much greater challenge, though the benefits could also be great.[52] We have not addressed the feasibility and desirability of broadening student working groups to include much younger ages, though this may be a question worth revisiting later, particularly in smaller communities where all ages attend a single school.

In addition to their project-based groups, each learner should be part of a "home group," a set of same-aged students that, as much as possible, remains together throughout their high school career. These home groups meet at regular intervals to provide a peer group with deeper connections for social support.

In this project-based model of learning, it is no longer relevant to speak of an optimal class size. Groups will be as big as they need to be for a particular project. Some projects, such as operating a school farm, may involve most or all of the learners in the school, with subgroups forming as needed to address particular tasks and questions. Other projects of tighter focus may need only a few learners or, in special circumstances, even just a single individual.

What matters instead of class size is the overall student to teacher ratio. Schools will need to provide an adequate number of teachers and other learning professionals to serve as facilitators and resource providers for every group. As outlined in Chapter 4, these professionals will shift from a "one teacher-one class" deployment to a more flexible system in which, for example, one teacher may provide support in statistical analysis or computer programming for several different projects running concurrently. The details of this flexible support system are likely to vary from school to school. Often, especially in regions where trained teachers are scarce, some of these resource needs may be drawn from others in the community. As a result, we cannot specify whether this model of learning will require more, fewer, or a roughly similar number of adults compared to the present system.

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52. Sudbury Valley School: http://www.sudval.org/

Flexibility of schedule

As students meet in different and often-changing groups to pursue their studies, they will find it helpful to adopt flexible schedules, as well. Without fixed, formalized classes, schools will no longer have rigid timetables in which students all move from class to class at the same time for short blocks. Instead, learners will sometimes need large blocks of time – for example, during construction of apparatus for a project or for visits to off-campus locations – and at other times need only relatively brief meetings for project updates or to answer specific questions. The school schedule should reflect and accommodate this.

Each learner should manage his or her own schedule, booking meetings with appropriate team members and resource persons as needed. This will require a great deal more initiative on the learners' part, but the art of scheduling should be within the abilities of high school learners – especially where electronic calendars are ubiquitous. Recent graduates are often expected to successfully manage their own schedules once they enter the workforce; having to do the same during their education helps them develop this important life skill.

Although learners' schedules will become much more flexible, this does not imply that attendance at school should be optional. Learners will simply have more ways of meeting their attendance requirement than they do today, just as employed adult workers may sometimes telecommute or work offsite. Most learners will be physically present at school most of the time during regular school hours, largely because this simplifies the scheduling of meetings and other project work and because many of the key resources, especially teachers and other education professionals, are located at the school. In addition, many valuable elements of education – not just knowledge and skills, but also socialization and lessons in teamwork – are most effectively delivered in that collective setting.

However, project-based learning also allows for other options where appropriate. Under some circumstances, individual learners may choose to work from home, communicating electronically (where resources allow) with teachers and classmates to verify that they are using their time productively – an option that may be especially suited to students with social difficulties or some special needs. At other times, individuals or groups of learners may find it most valuable to leave the school to visit universities, local companies, or other sites that have information and resources needed for their projects, or to take on apprenticeships or internships, as many high school students already do in some jurisdictions. All these options will be encouraged, as long as they enhance the students' learning opportunities. It will be up to the learners to justify their use of these alternatives, and to demonstrate that they have remained productive while not at school. These off-site options are most likely for older learners; for the youngest in the high school population, the school's duty of care may require somewhat more direct supervision, except in special cases.

Flexibility of learning spaces

Many schools are already moving away from square classrooms with rows of desks and creating more open, flexible learning spaces suitable for newer ways of learning.[53] At Ngee Ann Secondary School in Singapore, for example, redesigned classrooms include a mathematical modelling room for hands-on mathematical learning, design rooms with bright colours and striking furnishings, and rooms optimized for discussion and collaborative learning.[54]

This trend fits well with our model of education. High school learning centred around projects will require spaces for large and small group discussions, individual work spaces, studios for art, construction and scientific experiments, and public spaces for presenting final project reports to larger audiences.

Literature already explores ways in which the physical design of schools can encourage these diverse interactions and enrich educational outcomes.[55] We leave the details to these experts and will not discuss their conclusions further here.

As valuable as they can be, however, these physical design changes are not essential to a high-quality education. All of the educational changes we propose can be carried out effectively in a simple, old-fashioned schoolroom, if learners and teachers are willing. Indeed, exploring ways to adapt existing school facilities to new needs may make a productive

53. See, for example, the OECD's Centre for Effective Learning Environments; http://www.oecd.org/edu/innovation-education/centreforeffectivelearningenvironmentscele/.
54. Ngee Ann Secondary School, 2013. "Future School: Ngee Ann Secondary School."
55. See, for example, Rudd et al 2006, OECD 2006, Prakash & Nair 2005.

project for one or more groups of learners. Our approach to education would even work for learners meeting under a tree in the village square, if that is what is available. What matters most is not the building but the learners and teachers who meet there.

Learning outside school

Many students, especially in wealthy societies, already do a lot of learning outside of school hours and school walls. They watch instructional videos on YouTube, listen to podcasts, browse information-rich sites on the Internet, play educational games, take massive open online courses (MOOCs), or watch television shows such as Mythbusters.

This out-of-school learning is likely to become even more important as education changes. Since learners will spend most of their time on projects investigating areas of interest to them, they should be more engaged and motivated to review information online, seek out instructional material, enroll in online courses, and pursue knowledge outside of school. Some learners may also seek out formal or informal apprenticeships in the wider community.

These out-of-school learning opportunities may be even more important in poorer communities where schools lack the funding to hire enough teachers with strong knowledge backgrounds. In these cases, many schools may opt to bring in virtual teachers, especially for more technical subjects. These may be pre-packaged courses viewed either online or through DVDs or other video material played on a shared computer or television. When this happens, schools will essentially be dividing the teaching role between live teachers providing learning support and individual attention in the classroom and virtual teachers supplying the knowledge base.

The role of the school in the community

One of the recurring themes within this Blueprint has been the importance of making high school education relevant to the learners themselves and to the wider community of which they are a part. This relevance is an important reason why we recommend that learning be based largely around projects

that address questions of interest to the learners, and it also motivates our call for learners to seek out community members to serve as resources whenever this is useful.

This relevance should flow in the other direction, as well. Teachers should encourage learners to choose topics that matter to their community. Often, projects may focus on some area of local need, and culminate in proposals for addressing that need. Students in PEAS schools in Uganda, for example, run small-scale farms to generate income to make the schools self-sustaining, while participants in the Project H program in California, US have built infrastructure such as public chicken coops, farmers' market stands, playgrounds, and their own school facilities.[56,57]

Members of the community, and even local governments, may sometimes approach schools with the goal of commissioning projects in areas of need. In some parts of the world, aid organizations and other non-governmental organizations may find that the best way to deliver some services is to partner with high schools to create the high school equivalent of Barefoot College for adult learners.[58] Such partnerships would benefit both parties, with NGOs gaining access to local knowledge, experience, and labour, and schools getting connections, resources, and knowledge.

This increasing practical relevance will automatically increase the school's profile and importance within the community. We encourage schools to take further steps to take on a role as community hubs. Most well-funded schools already have gymnasiums, auditoriums, and other facilities that can be used by the community outside of school hours. Similarly, the community could be encouraged to make use of school libraries and other resources when not in use by students. Conversely, schools can make use of community facilities such as playgrounds, green spaces, and libraries.

Both community and school can, and in many places already do, benefit from going further still, by housing other community resources such as child-care centres, community centres, and community arts facilities into the school space.[59]

56. PEAS Smartaid Schools in Africa: http://www.peas.org.uk/our-schools/faqs
57. Project H Design: http://www.projecthdesign.org/info/
58. Barefoot College; http://www.barefootcollege.org/barefoot-approach/
59. American Architectural Foundation, 2006. "Report from the National Summit on School Design: A Resource for Educators and Designers," p 35

Assessment

COMMUNICATIONS

CREATIVITY

TEAM WORK

RESOURCEFULNESS
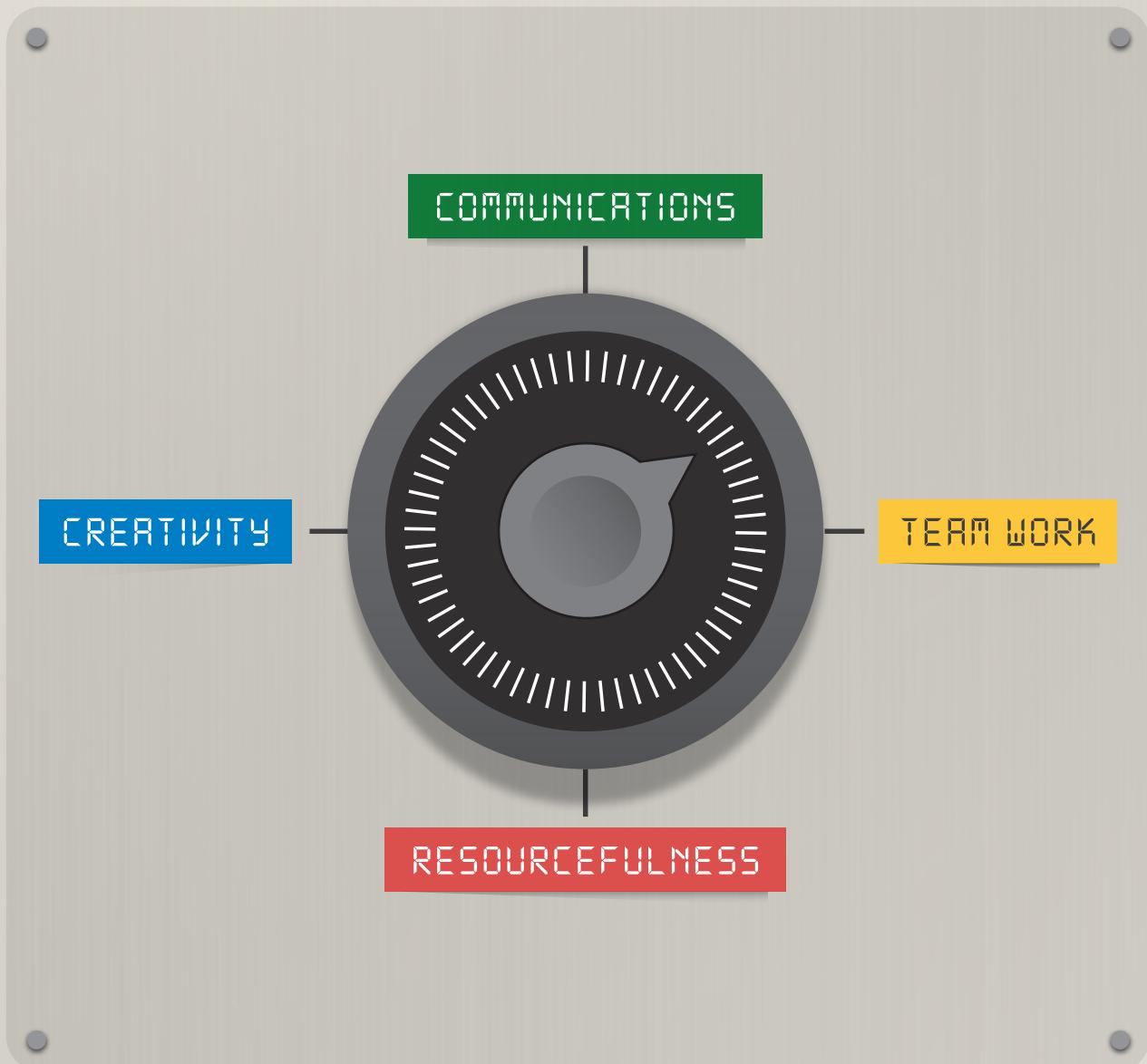
Introduction

Throughout this Blueprint, we have argued that to maximize its usefulness in the 21st century world, high school education must shift its emphasis away from simply conveying information, and instead must emphasize broad Habits of Mind and the skills learners will need in order to find, assess, and process information. This shift will require major changes in curriculum, teaching methods, teacher training and support, and school structure, as we have discussed in Chapters 2–6. In this chapter, we discuss another major change that will be necessary: change in the way we assess student progress.

Assessment is vital for students, who need to be aware of the progress they are making and their areas of weakness and of strength. However, the most widely-used assessment methods, which generally centre on formal examinations of various types, are best suited to measuring recall of information. They are far less effective at measuring "softer" skills such as teamwork, creativity, and resilience. Since these latter skills are precisely what we most want to teach, schools must find better ways to measure students' mastery of them, or else risk having incentives that run at cross purposes to their true goals.

Assessment serves three distinct functions in education today:

1. Provides feedback to learners – about their progress, strengths, and areas for improvement

2. Sorts students by level of achievement – used by employers, post-secondary educational institutions, and others in their hiring, selection, and credentialing process

3. Provides data for evaluating the performance of schools and school systems – so that administrators can reward those that are performing well and act to remedy those that are performing poorly

The second and third of these functions do not directly benefit the student's learning process. Indeed, as we shall see in a moment, they often actively interfere with successful learning by driving the system away from good learning experiences. Therefore, we propose that student assessment should focus exclusively on the one role that is an intimate part of the learning process, namely providing feedback to students. In the final section of this chapter, we will briefly discuss how the latter two functions, sorting and school assessment can be handled in other ways.

The role of examinations and grading in assessment

We will begin this section by laying out what most will see as a radical proposal. We recommend that schools abandon the use of formal examinations and grading in student assessment.

Grades focus attention on outcomes, not the learning process itself. As a result, the grade often becomes more important than what was actually learned. Some exams – notably finals and state or national standardized tests – deliver feedback only when it is too late to refine further learning for that student in that subject. Furthermore, grades encourage the wrong kind of competition in school – competition between students – and do a poor job of encouraging the right kind of competition, namely the internal competitiveness that drives a learner to do his or her very best. Internal competitiveness leads students to work toward continual improvement, rather than some absolute target. Internal competitiveness motivates every student, regardless of their background or level of ability, to perform at their highest possible level.

Exams are ineffective at measuring what we most value in education and, increasingly, post-secondary education and industry: creativity, resourcefulness, teamwork, communication and related skills. These "soft" skills are difficult to quantify and difficult for students to demonstrate during a high-pressure formal examination. Students can display these skills most effectively while engaged in practical projects, not highly artificial exams. The failure of exams to measure these skills is clear anecdotally from the many highly capable, highly intelligent individuals – for example, Thomas Edison and Richard Branson – who do badly in school. However, more quantitative data sets also back up this point.[60] For example, test scores do a very poor job of predicting entrepreneurial ability, which is one of the soft skills that education should work to foster. Indeed, countries with higher PISA test scores tend to score lower, not higher, on measures of entrepreneurial activity.[61]

For many students, exams and formal grades are demotivating and lead to disengagement from learning. FutureLab, an educational research centre in the UK, puts this most clearly: "Most examinations and tests are designed primarily to assess whether a student has made a particular grade or to identify what grade they have achieved, according to some standardized or tailored scale. Their primary purpose, therefore, is not to support learning but to categorize the learner – arguably

60. Heckman, James J, and Tim Kautz. 2012. "Hard Evidence On Soft Skills." Labour Economics 19: 451-464
61. Busteed, B, 2013. "The Economics of Human Development" at Equinox Summit: Learning 2030, Waterloo, ON.

to identify what they cannot do rather than what they can do." [62] By focusing on a student's weaknesses rather than strengths, exams and grades can discourage students from believing they can succeed – not just at the task being tested, but at other tasks as well: "Comparison with others who have been more successful is unlikely to motivate learners. It can also lead to their withdrawing from the learning process in areas where they have been made to feel they are 'no good.'" [63] This is especially true of learners with disabilities, immigrants or others who are not fluent in the dominant local language, or who come from disadvantaged socioeconomic backgrounds. This tends to increase the achievement gap between these students and those from more advantaged backgrounds, and thus helps perpetuate social inequality.[64]

Exams often lead to "teaching to the test," particularly when test results are used to evaluate the performance of whole schools. This discourages learners from following their own interests or digging deeper into productive topics that arise serendipitously, and thus narrows their learning opportunities. It also prevents teaching teams from doing the best job they are capable of, and has led to significant disengagement amongst learning professionals.[65]

For all these reasons, student assessment should move away from exams and formal grades in favour of other forms of assessment that offer greater educational advantages. Many of these forms of assessment are already in use in almost every classroom, though often overshadowed by exams. Others have expressed a similar wish: "Assessment that encourages learning fosters motivation by emphasizing progress and achievement rather than failure [...] Motivation can be preserved and enhanced by assessment methods which protect the learner's autonomy, provide some choice and constructive feedback, and create opportunity for self-direction." [66]

Evaluating progress

Learners' progress should be assessed interactively and continuously as an intrinsic part of the learning process. Project-based education offers ample opportunity for learners to receive feedback on their progress through self-reflection, from their peers, from teachers, and from outside experts drawn from the community. In this way, learners should know at all times what their strengths are, where they have room for improvement, and how they are addressing their progress. Because of this, learners should receive more assessment, not less, despite doing away with formal exams.

Not only will this improve their learning outcomes, this form of continual assessment parallels what will happen throughout a learner's life once they leave formal schooling. In the world outside of school, the key skill is learning itself – how one gets better at what one does, at work and in life as a whole. Assessment in school should follow the same lines. In our project-based learning, groups of learners will continually be evaluating their progress toward the project's goal, and how their knowledge and abilities are affecting their performance and that of the group. Every group member will have frequent opportunity to reflect on what they have accomplished so far, what has worked and why, and where they have fallen short of, or surpassed, their goal and why. As group members meet for discussion, each will gain experience both at assessing the work of others constructively, and at receiving others' assessments in a productive way. In addition, learners will receive input from teachers and other learning professionals, and sometimes from experts drawn from outside the school.

Implementation of reformed assessment

This system of assessment lays the foundation for deeper learning and stronger student achievement by supporting the learner with critical information that can help direct their learning pathway. At the beginning of each school year, each learner will meet individually with a teacher-mentor to lay out the learner's goals for the year, identifying the particular skills and Habits of Mind that have top priority for that year, and identifying some of the subjects the learner is most interested in exploring. These are the goals against which the learner will be assessed in the year to come.

One of the strengths of this approach is that this kind of assessment has actually been going on informally in classrooms for many years. As the Assessment Reform Group observed more than a decade ago, "Much of what teachers and learners do in classrooms can be described as assessment.

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62. Futurelab Social Justice report

63. Gardner, J et al. "Assessment and Social Justice," a Futurelab literature review: Report 16.

64. Ibid.

65. Moon, T. R., Brighton, C. M., Jarvis, J. M., & Hall, C. J. (2007). State Standardized Testing Programs: Their Effects On Teachers and Students (RM07228). Storrs, CT: The National Research Center on the Gifted and Talented, University of Connecticut.

66. Assessment Reform Group, 2002. "Assessment for Learning: 10 Principles"

Much of the apparent rigour of quantitative grades is a false one: there is no practical difference between a grade of 79% (often assigned a letter grade of B) and 81% (often assigned an A).

That is, tasks and questions prompt learners to demonstrate their knowledge, understanding and skills. What learners say and do is then observed and interpreted, and judgements are made about how learning can be improved. These assessment processes are an essential part of everyday classroom practice and involve both teachers and learners in reflection, dialogue and decision making."[67]

In other words, teachers are already skilled at identifying the strengths and weaknesses of individual students and providing the kinds of feedback we envision. In most classrooms today, however, this informal assessment takes a back seat to formal exams and grading – which, we re-emphasize, have no justifiable place in the 21st century learning process. Teachers are likely to require some additional training to assist them with the transition as they eliminate exams and grades completely and shift exclusively to formative assessment and feedback. In addition, new applications such as Learning Analytics will allow teachers to tap the power of technology to gauge students' understanding and misconceptions with a subtlety that even well-trained humans cannot.[68]

The increased attention to formative assessment may require more time and attention from teachers, but this should be offset by the time saved by no longer preparing, administering, and grading exams. From time to time, learners may want to test their own knowledge about a particular subject to satisfy themselves that they have mastered certain skills or areas of knowledge – for example, to be sure they understand a statistical procedure before analyzing a data set, or to reassure themselves that they know enough historical context for a particular project. When these needs arise, learners can turn to available tools, such as online self-testing and review modules, to test their own progress without the stress of formal assessments via exams. Such resources are already widely available for many subjects. If schools adopt the reforms we recommend, a critical mass should soon develop that will encourage third-party providers to produce more such modules.

67. Ibid.
68. Society for Learning Analytics Research: http://www.solaresearch.org/

Indeed, abandoning these numerical comparisons will eliminate a lot of unproductive focus on test scores among teachers and school administrators and put the emphasis back where it belongs – on the learners themselves, and the progress they make.

A flexible progression

Most educational systems today measure student progress through a final exam at the end of the year, and the final grade represents that progress. In other words, the system treats time as the constant and achievement as the variable. Our proposed alternative reverses this by holding achievement as the constant and taking time as the variable – a practice that at least some school systems are already moving toward today.[69] Students can continue to work on a skill or concept until they master it, even if it takes several projects spanning more than one year. This frees students to progress at their own pace, rewards persistence, and gives every student the satisfaction of successful completion. Learners will meet with their teacher-mentor regularly throughout the year to review progress, refine goals, and plan strategies for the learner to attain those goals.

Since schools will no longer assign grades for particular courses, they will need to develop a different method for keeping track of learners' progress throughout their high school careers. Schools may differ in how they choose to do this. Some may track students' advancement along a learning progression for a particular concept, others may use portfolios of student work to demonstrate development.

Assessments that focus on learners' progress and not their deficiencies produce better educational outcomes because they reduce the discouragement and disengagement that poor exam scores often produce.[70] This benefit is especially notable for students from disadvantaged backgrounds, who disproportionately share in that disengagement.[71]

The success of this exam-free, exclusively formative assessment can be seen in the results of The Independent Project. Participants in that project received weekly assessments from their peers and prepared portfolios of their work. The project's final report concludes that "These forms of evaluation were effective because the purpose of the evaluation wasn't the evaluation itself, but what it would lead to." This took the emphasis and pressure off of the evaluation, and put it on the process and the work. In this way the need for summative assessment was nullified and the formative assessments became what they intended to be. They led to more learning, and improved the students' work.[72]

Ranking graduates

Today's society uses high school assessments not just to measure student progress, but for many additional purposes. In particular, course grades as recorded in a student's transcript are often used by universities and other post-secondary educational institutions to select which students they will admit. High schools should no longer provide this service, since the grading that it requires is detrimental to the education we seek to provide, for the reasons discussed above.

Despite its lack of easy-to-use numeric grades, a strictly formative assessment is in fact just as rigorous as the present system. For one thing, much of the apparent rigour of quantitative grades is a false one: there is no practical difference between a grade of 79% (often assigned a letter

69. See, for example, the US state of New Hampshire (http://www.education.nh.gov/innovations/hs_redesign/index.htm), the RSA Opening Minds initiative in the UK (Aynsley, S, et al 2012. Opening Minds: An Evaluative Literature Review; http://www.thersa.org/action-research-centre/learning,-cognition-and-creativity/education/practical-projects/opening-minds/opening-minds-an-evaluative-liturature-review), and the Lumiar schools in Brazil.
70. OECD, 2005. "Formative Assessment: Improving Learning in Secondary Classrooms." Policy Brief.

grade of B) and 81% (often assigned an A). There certainly are differences in achievement and ability between students with grades that differ more widely, but these distinctions – if they need to be made at all – can be drawn just as easily through qualitative evaluations.

Some universities, employers, and any others who currently rely on high school transcripts might find themselves balking at the task of finding other ways to sift candidates. However, many of the more sophisticated and successful institutions and industries have already recognized the limitations of using exam grades. Many universities – including some of the most prestigious – rely on a combination of essays, community service, and third-party tests such as the Scholastic Aptitude Test (which, admittedly, has its own flaws) in addition to high school grades in making their admissions decisions.

A few businesses may check high school grades when hiring recent graduates. Most, however, merely want to see evidence that a prospective employee has completed high school, so abandoning formal grades should have little impact on direct hiring decisions. Grades on a high school transcript can also be used as proof that students have mastered particular skills, such as computer programming, music performance, or automobile repair. Since our learners will no longer receive grades, this credentialing function will also need to shift to independent providers, and learners should be encouraged to seek these third-party credentials whenever appropriate.

Comparing schools

Most school systems also use exam scores – particularly scores on system-wide, standardized tests – as a measure for comparing the performance of schools. Test scores, appropriately corrected for socioeconomic factors, can help highlight exemplary schools that are doing an exceptional

job of educating their students. They can also identify schools that need to take remedial measures in order to deliver a high-quality education. States, provinces, and even whole countries also rely on standardized tests such as PISA for benchmarking their performance relative to other school systems.

These functions, too, will have to change as our schools do away with the exams that form the basis of these school comparisons. What will replace them? We emphatically agree that schools will continue to need some sort of quality control to ensure that they are doing their job. However, evaluators can assess a school's effectiveness without making numerical comparisons between schools. Such a system has proved effective and advantageous in Finland. Indeed, abandoning these numerical comparisons will eliminate a lot of unproductive focus on test scores among teachers and school administrators and put the emphasis back where it belongs – on the learners themselves, and the progress they make. Our recommendations for school oversight will be discussed in more detail in Chapter 7.

International comparisons may be less urgent in the future, if stakeholders are convinced that their education system is delivering high-quality results. Indeed, some experts question their real utility even today.[73] In the meantime, however, any data needed for such comparisons can still be generated in a way that does not detract from the learning journeys of individual students. Much of the damage done by testing comes from the pressure it exerts on individual students by encouraging competition and a focus on results rather than process, and on teachers and schools by encouraging teaching to the test. Standardized tests that do not identify individual students or schools, and do not return results to the tested, could be used to provide data for international comparisons with few drawbacks.

71. Gardner, J et al. "Assessment and Social Justice," a Futurelab literature review: Report 16

72. Levin, S, 2011. "The Independent Project" White paper. http://www.theindependentproject.org/the-white-paper/, p 12

73. Mansell, W. "PISA: Debunking Some of the More Questionable Claims." http://www.naht.org.uk/welcome/news-and-media/blogs/warwick-mansell/pisa-debunking-some-of-the-more-questionable-claims/; Ravitch, D, 2013. "My View of the PISA Scores." http://dianeravitch.net/2013/12/03/my-view-of-the-pisa-scores/; Baker, K, 2007. "Are International Tests Worth Anything?" Phi Delta Kappan, 89(2), 101-104

Organization

Schools

Teachers

Students
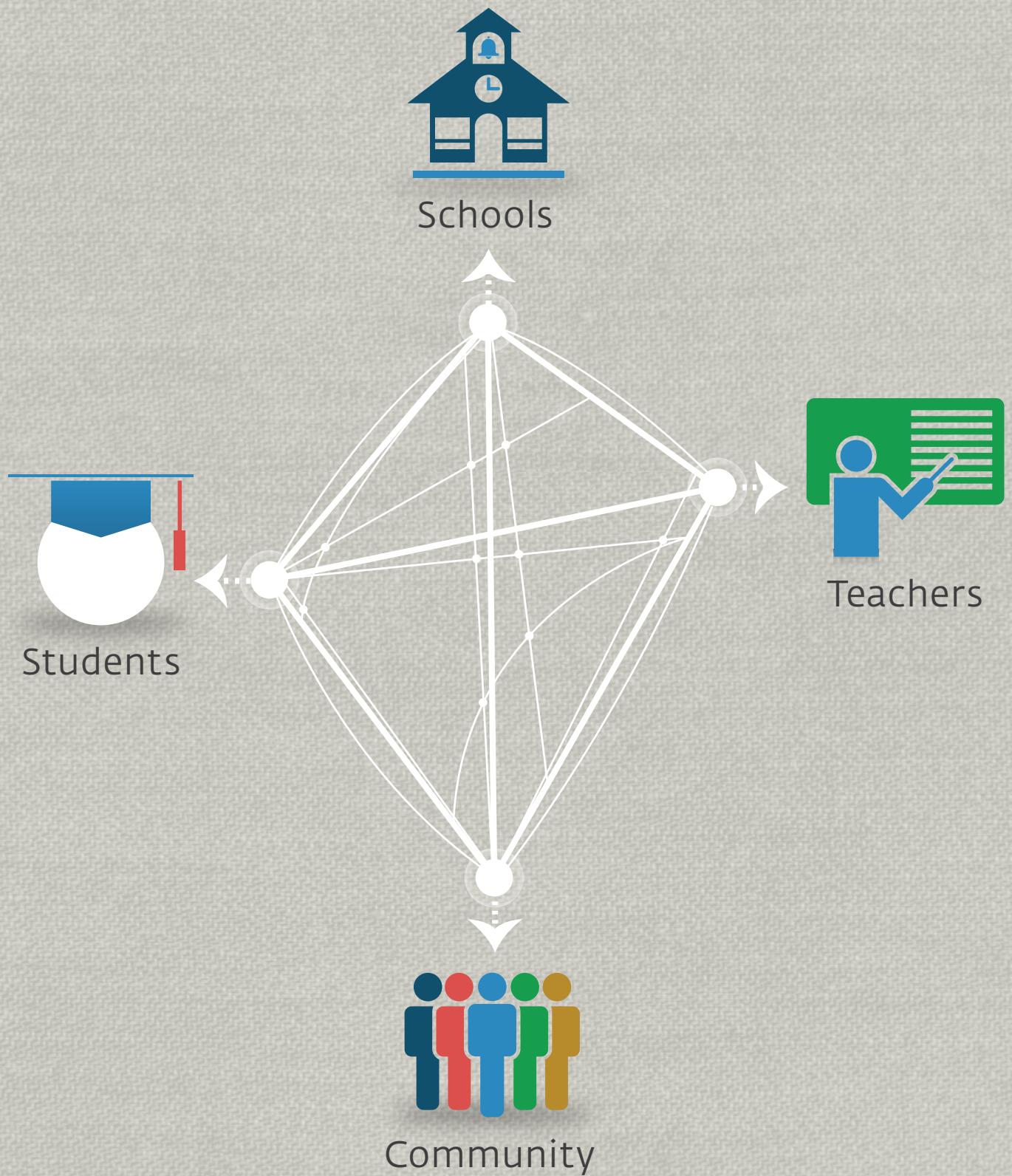
Community

Introduction

Schools do not exist in a vacuum: they are part of a community, often in a network of schools, and overseen by local government or similar authority. Their learners will eventually seek to take up places in higher education or in employment. This means that lasting, impactful change is best implemented in the larger system. We propose that the components of this larger whole be thought of as an ecosystem, rather than a hierarchical series of superstructures imposed one on top of the other.

Because we are focusing on a general design here rather than specific implementation, this chapter will discuss the elements of this ecosystem in generic terms. We will outline how each element can support our new direction for learning, and how they should interact if the transition is to be successful and sustainable. The specific details of any particular implementation will need to be adapted to local conditions and governance.

The specific desired outcomes of the learning journey must be determined through mechanisms that include all stakeholders. That means making the goals explicit to students, teachers, parents and caregivers. Since the end goals of high school education will almost certainly change, similar discussions outside the school must engage local employers, industries and higher education establishments with our vision of the new type of learner as a more desirable employee, entrepreneur, community member and student in higher education.

COMPONENTS OF THE LEARNING ECOSYSTEM

Partnership Council

Each school, or group of regional schools, should be overseen by a committee of stakeholders representing parents and caregivers, primary, higher and further education professionals, community groups and leaders, student voice and local employers. This local oversight is essential to our goal of linking schools tightly with the communities in which they exist. This Partnership Council, together with the school itself, helps determine the school's unique "flavor," pushing, challenging, and supporting learning within that community.

The council takes responsibility for ensuring that the school is running well, maintaining its autonomy, protected from inappropriate government or school board interference and delivering the kinds of learning opportunities for which it was established. The council will also help establish and provide critical feedback on the appropriate school calendar and day structure. Though the rich variety of local contexts and requirements prevents us from making explicit recommendations, this will almost certainly differ from the structures presently in place – though not necessarily from the structures that have been recommended.

In 2012 the RSA pointed out, that in the UK, the case for school-based curriculum design "seems to have been won. Politicians and headteachers appear to agree that the nationally prescribed body of knowledge contained in the National Curriculum should provide a minimum entitlement, but should not define everything that is taught in schools."[74] In the UK, the national curriculum was only meant to take 80% of time in school, providing a minimum requirement. The remaining 20% was intended as time directed by the school working as an autonomous body, focused on giving wider experience, often directed by aspects of the local community. In a 2011 review, Tim Oates, Chair of the Expert Panel for the National Curriculum review, reported that this "vital" distinction has been generally lost.[75] However, where it applies, schools appear to be more successful, according to an OECD analysis.[76]

Another OECD analysis, published in 2004, declares that a "focus on improving school quality, particularly in terms of improved student performance, is closely aligned with school autonomy."[77] The report goes on to state that "In most of the countries that performed well in PISA 2000, local authorities and schools now have substantial freedom to adapt and implement educational content and/or to allocate and manage resources" and "In PISA countries, there is a clear positive relationship between certain aspects of autonomy and performance, most notably the choice of which courses are offered, and to a lesser extent autonomy over budget allocation." Giving principals the authority to recruit teachers that they sense will work best in their school is another area of autonomy that has significant positive impact. Studies have shown that an effective principal can create a significant improvement in the overall effectiveness of the teaching body in the school.[78]

74. Thomas L, 2012. "Thinking about an Area Based Curriculum: A Guide for Practitioners," RSA
75. NAHT, 2011." Way Beyond 'Just Knowledge' – The Direction of the National Curriculum Review." http://www.naht.org.uk/welcome/news-and-media/key-topics/curriculum/national-curriculum-way-beyond-just-knowledge/
76. OECD, 2009. "Education at a Glance 2009" www.oecd.org/education/highereducationandadultlearning/43636332.pdf
77. OECD, 2004. "What Makes School Systems Perform?" www.oecd.org/dataoecd/30/24/33858946.pdf
78. Center for Public Education. "The Principal Perspective: Full Report." http://www.centerforpubliceducation.org/principal-perspective

The Partnership Council will operate its accountability measures towards the school management/principal, and towards the government/school board, and will have authority to reject specific measures suggested from either direction without risk of losing funding essential to maintaining the smooth and continual learning opportunities the school offers.

Governance/school board

According to a World Bank report, "School autonomy and accountability are key components to ensure education quality. The transfer of core managerial responsibilities to schools promotes local accountability, helps reflect local priorities, values, and needs, and gives teachers the opportunity to establish a personal commitment to students and their parents." [79]

The government or school board should continue to set the learning goals for its schools – the detailed list of skills and competencies, breadth and depth requirements for graduation and suggested subject areas for projects. However, the autonomy of schools is key to fostering localized innovations. Schools should be free to implement strategies to achieve the learning goals as they see fit. Being accountable to the government/school board means there will be checks and balances in place to ensure this is a positive change. According to the World Bank, one place this system has worked well is Finland. Chris Husbands, Director of the Institute of Education, University of London, says that, as long as it occurs within a coherent education system, "the evidence from the world's most successful systems is that school autonomy is part of what is needed." [80]

It is worth emphasizing that the chief role of the school board is in ensuring standards are being met. As the OECD points out, where accountability measures fail, autonomous schools provide far lower quality of education. "In countries where schools have greater autonomy over what is taught and how students are assessed, students tend to perform better, says a 2011 report. However, in countries where schools do not post achievement data publicly, "schools with greater autonomy in resource allocation tend to perform worse." In short, the report says, school autonomy in allocating resources tends to be associated with good performance in those education systems where most schools post achievement data publicly. This suggests that creating a combination of several autonomy and accountability policies, not just a single, isolated policy, is related to better student outcomes." [81]

School leadership

The most important role of the school principal is to be the chief risk-taker for the school – a role rather different from the principal's role today in most systems. They will manage a system that constantly innovates through trial and error. They are freed from a system where the performance of their institution is consistently measured against the performance of other, fundamentally different institutions. Yet they are still concerned with results and outcomes. The job description, therefore, is one of an entrepreneur who must steer learning professionals and learners towards successful integration of learners into the next stage of their learning journey. It has been compared, in one excellent book on transformational school leadership, to rebuilding a passenger jet – while the jet is flying and full of passengers. [82]

The principal will be a partner of the Partnership Council of parents and caregivers, local industry, and community members. The principal will also be a partner of the school board or government that feeds and supports the school. The principal's performance will not be measured on grades or numbers entering higher education, but on reports compiled by the stakeholder group comprising factors such as learner engagement, teacher and other learning professional engagement, community reactions to school graduates' performance (in education, community roles, professional work and so on). The school's reputation will not be built on achieved grades or even grade improvement over a learner's time at the school, but on its graduates' success in post-secondary life, as measured by feedback from employers and higher education institutes to the stakeholder committee and other groups.

This is clearly an enormous shift, and runs the risk of allowing under-performance to go unchallenged for long periods of time. Known issues include "social loafing," where students under-perform because of the absence of high-stakes testing; it also means parents can't put pressure on students to study in "exam season," making it perhaps more difficult for them to

79. World Bank. 2012. "Finland - School Autonomy and Accountability. Systems Approach for Better Education Results (SABER) country report." http://documents.worldbank.org/curated/en/2012/01/18104059/finland-school-autonomy-accountability

80. Institute of Education, University of London. "School Autonomy Must Sit Within A Coherent System, IOE director tells Conservative Party conference fringe meeting." http://www.ioe.ac.uk/57694.html

81. OECD, 2011. "School Autonomy and Accountability: Are They Related to Student Performance?" PISA IN FOCUS 2011/9 (October).

82. Tony Wagner et al, 2005. Change Leadership: A Practical Guide to Transforming Our Schools, John Wiley & Sons (2010)

know how to engage with their children's learning. However, the self-motivation in our vision of learning will be much higher than in traditional forms of education, and these issues are unlikely to manifest as problems. Nonetheless, assessment criteria and pathways for performance-checking and ongoing improvement of the school and its principal should be introduced and established. As these will depend on local context, we consider it beyond our scope to lay out details of such measures here. However, such measures do exist, and more are being developed.[83]

Typical Staff Turnover

ATC21S Staff Turnover
(Reduced 25–75%)
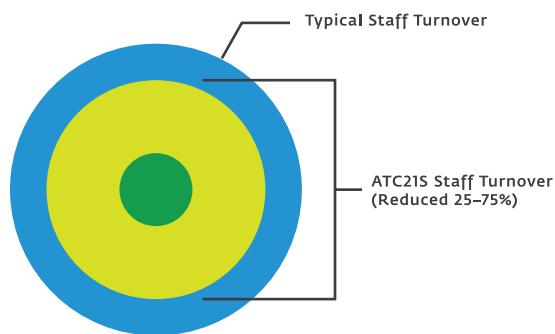
Employers and tertiary education institutions

The change will be similarly significant for those who will partner with these learners after they leave high school. It cannot be denied that employers and higher education institutions will have some adapting to do in order to sift candidates with new-style assessment portfolios. However, many among them are already moving in this direction, having realized that traditional grades provide an unreliable measure of the skills and qualities of those who are coming their way. The College Board, for example, has instigated a project that tests analytical, practical and creative skills to supplement the SAT scores traditionally used for college entrance testing.[84] This has had the effect of reducing disparity between ethnic groups in terms of college acceptance.[85]

Similarly, employers have shifted their criteria for employee selection. In a national survey of business and nonprofit leaders in the US, 93% said they valued "a demonstrated capacity to think critically, communicate clearly, and solve complex problems" over a candidate's undergraduate major.[86] 95% said they are looking for employees who will be able to innovate in the workplace and demonstrate ethical judgment and integrity, intercultural skills and the capacity for continued new learning. Though it is not yet clear how employers will assess these skills, there are moves to make that possible. For example, the Australian organization, ATC21S, is developing assessment techniques for 21st century skills.[87] Employers who have already incorporated skills-based hiring into their practices have seen a 25–75% reduction in staff turnover, 50–70% reduction in time to hire, 70% reduction in cost-to-hire and a 50% reduction in time to train, according to research by Gates Foundation-funded research.[88] In short, skills-based hiring is five times more predictive of success on the job than hiring by degree alone. The improved performance of the lifelong learners emerging from these shifted learning environments equipped with powerful Habits of Mind will be significant enough to raise engagement and make the inconvenience of re-thinking entry criteria worthwhile.

Teachers

The specific path that needs to be taken to reach the learning goals should be determined inside individual places of learning, rather than imposed from a higher level. Though government and school boards will set learning goals, teachers and other learning professionals will be free to draw on their own experience and understanding to help guide learners towards the best way of reaching their learning goals. To this end, school principals should work with teachers and learners to find the best learning methods for each context.

We see teachers fitting very comfortably into such an ecosystem and enjoying respect and freedom while understanding what it is they are expected to deliver. Research carried out in British Columbia, Canada, and elsewhere has shown that teachers become most engaged when they see themselves as

83. See, for example, http://www.wallacefoundation.org/knowledge-center/school-leadership/principal-evaluation/Pages/default.aspx

84. Stenberg, R, 2006. "The Rainbow Project: Enhancing the SAT Through Assessments of Analytical, Practical, and Creative Skills." http://dx.doi.org/10.1016/j.intell.2006.01.002

85. Jaschik, S, 2010. "College Admission for the 21st Century." http://www.insidehighered.com/news/2010/09/28/sternberg

86. Hart Research Associates, 2013. "It Takes More than a Major: Employer Priorities for College Learning and Student Success."

87. Assessment and Teaching of 21st Century Skills (ATC21S): http://atc21s.org/

88. Cobb, A, 2013. "Solving the Hiring Disconnect: Focus on Skills." http://www.impatientoptimists.org/Posts/2013/08/Solving-the-Hiring-Disconnect-Focus-on-Skills

89. C. Naylor and M. White, 2009. "The Worklife of BC Teachers in 2009: A BCTF Study of Working And Learning Condition's (Vancouver, BC: BC Teachers' Federation, 2010). http://www.bctf.ca/uploadedFiles/Public/Issues/WorklifeWorkload/2009/FullReport.pdf

What US Business Leaders are looking for in employees

Capacity to:
think critically +
communicate clearly +
solve complex problems

93%

Ability to innovate in the
workplace + demonstrate
ethical integrity

95%

key contributors to students' learning and development.[89] What is more, working with colleagues in schools while given high levels of autonomy "provided high satisfaction and increased teacher engagement." Conversely, where these factors are absent or negative, "teacher attrition is likely to increase." Freed from teaching methodologies imposed from above, teachers in our system are likely to experience a large increase in engagement. However, given the radically different environment, it is worth noting that training for teaching within this ecosystem will need significant shifts, and should include specific training on the way the ecosystem works – especially in the efficient use of knowledge networks we will introduce shortly. We address wider issues of teacher training in Chapter 4.

Learners

Learners will see an increase in their influence on how learning happens and what they are to learn, which should create a huge upswing in engagement. It is an essential consequence of our Learners' Charter of Rights (see Appendix) that student voice should be heard and appreciated at every level of decision-making in the learning ecosystem. This voice should not be sought as an afterthought that rubber stamps decisions that have already been made, but as part of the process of sifting evidence and opinion in pursuit of optimal learning strategies. Our new system puts the learner at the centre of the learning process and it is vital that the large size of the educational infrastructure does not dilute the influence and involvement of the learner in determining what that infrastructure allows to happen. Student voice has been shown to be a key contributor to individual academic success and resilience, and to institutional success.[90]

Community (including parents and caregivers)

With the right implementation, the learners' parents and caregivers, and the local members of the public, will have an increased role to play in this learning ecosystem. The new setup involves as many members of the school's community as can be arranged taking on roles as supporters of learning, whether through school visits, home-based support, hosting work experience or project support roles. It is only natural that members of the community will have some skepticism towards such a shift in education provision, but the results will quickly speak for themselves.

The learning network

An essential part of the learning ecosystem will be the networks through which students, teachers, schools and leaders share methodologies and experience. Though each school runs its own show, there is no reason, in this age of easy communication, for individual establishments and individuals to re-invent the wheel or spend time researching methodologies that others in their network are already aware of. We see the ecosystem to be one of knowledge-sharing for mutual and global benefit. Communities of learning professionals are already heading into this sphere, and the learning ecosystem should include structures that make it ever easier.

90. Fox, K. et al, 2013. "Student Voice and Resilience in Learning." http://www.ascd.org/ascd-express/vol8/825-fox.aspx

91. Boergers, J et al, 2014. "Later School Start Time is Associated with Improved Sleep and Daytime Functioning in Adolescents." 2014 Jan;35(1):11-7 (see http://www.ncbi.nlm.nih.gov/pubmed/24336089 for a summary)

Reports of failures, as well as successes, must be transmitted through the networks of the learning ecosystem without fear of derision or censure.

Encouraging experimentation, innovation, use of data and research

Our Blueprint does not guarantee success in every detail in every school. Indeed, we confidently predict that the adaptation and implementation of our recommendations will fall short of our goals from time to time. Schools will need to embrace this risk by encouraging learning methodologies and learning environments that know how to fail "smartly." It is vital that schools welcome occasional failure as an opportunity to learn valuable lessons. Reports of failures, as well as successes, must be transmitted through the networks of the learning ecosystem without fear of derision or censure. Failure should be analyzed, and analyses transmitted to others, in order to shorten the innovation cycle that leads to improved learning experiences.

We do not advocate the supremacy of data in all situations, but when relevant, high quality data sets are available, they should be informing open, transparent decision-making processes. In an age where information is so easily available, and where so much high-quality research into learning has been carried out, it is negligent to base any decisions that will affect learning outcomes on vague senses of what is the right thing to do in a given situation. Where high-quality evidence points to the benefits of a particular methodology or practice, all inhabitants of the learning ecosystem must be prepared to ask serious questions of any ideologies, gut feelings, traditions or cultural proclivities that stand in opposition to its conclusions.

An example might be in scheduling the school day. Research suggests that, if improved engagement in learning is a goal, school hours might be better set with reference to our understanding of circadian rhythms in the brain rather than by existing bus timetables or typical business hours. For example, a 25-minute delay in the start of the school day has been shown to increase sleep duration on a school night and improve the mood and attentiveness of students.[91] Members of the learning ecosystem will have the freedom to allow the learning goals to drive the format of the system. That is not to say data will always trump cultural considerations, but a strong network will allow dissemination and discussion of evidence and suggestions for putting its lessons to work. Individual experience can inform adaptations of this evidence's conclusions to particular situations, again, through networking loops.

Conclusion

A school should exist within an ecosystem that makes local employers, higher education institutions, community groups, parents and caregivers all partners in the learning experience. Schools should operate with autonomy as far as budget allocation, teaching methodologies, trials of new practices and specific learning goals are concerned, but must remain accountable to an oversight group composed of representatives from the various groups within the learning ecosystem. The skills and abilities of the school principal are central to the successful operation of this model for learning.

Cost and Funding
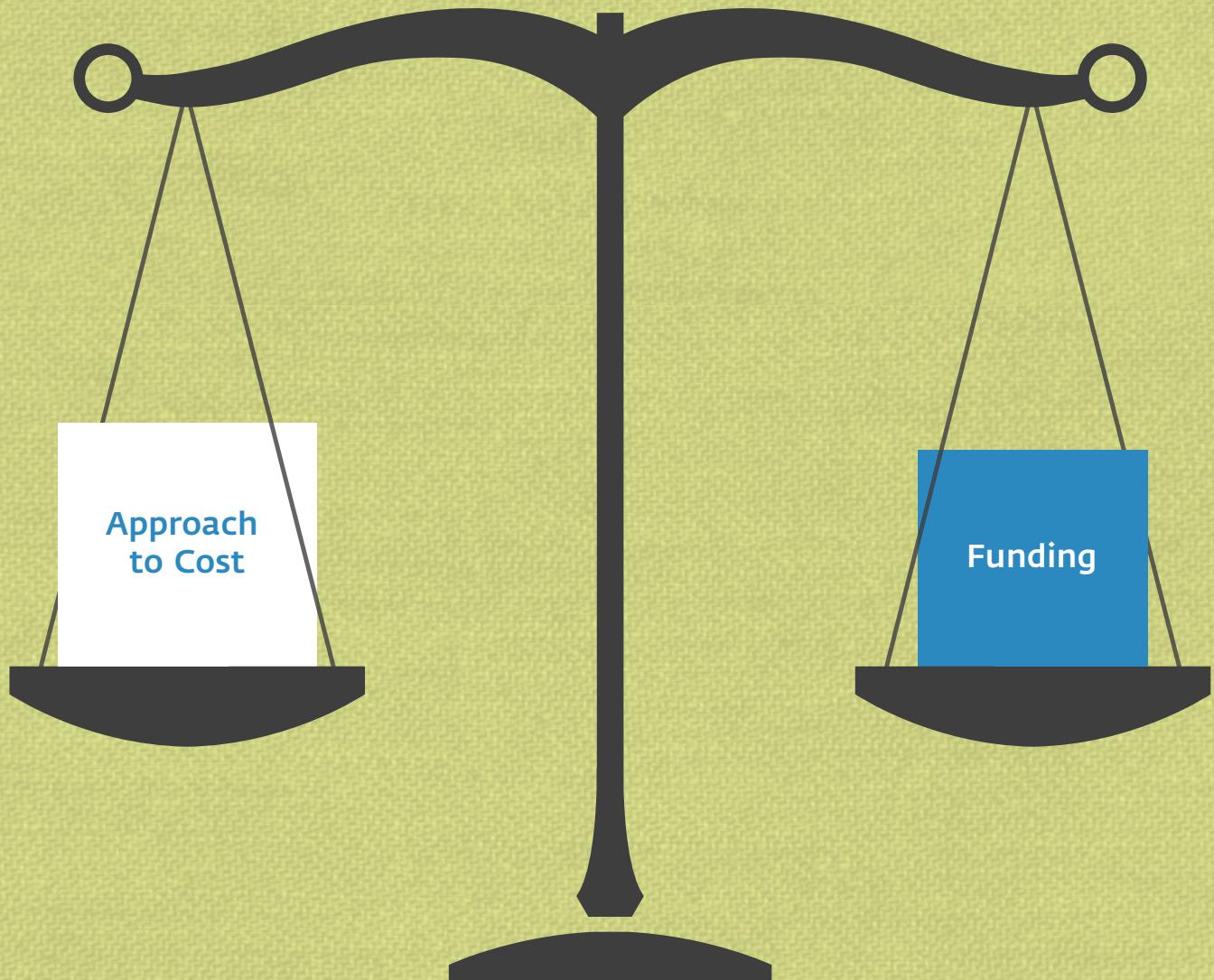
Finnish education expert, Pasi Sahlberg, says the much-lauded transformation of the Finnish education system came "at a reasonable cost." [92]

So reasonable, in fact, that 98% of the cost of education at all levels is covered by government rather than by private sources – and, indeed, Finland's education spending per child is not far from the OECD average.[93] Overall, Finland spends about $1,200 less per student than the US' $8,700 per-pupil average,[94] with learners having fewer hours of instruction than in any other OECD country. At the lower secondary level, Finnish teachers teach around 600 hours per year, compared with around 1,080 hours for middle school teachers in the United States. The interesting result is that Finnish 15 year olds outperform their peers in other nations – at least, in terms of the PISA results – despite the equivalent of three fewer years of schooling.

Introduction

With all the changes we are proposing – and we are aware that they are radical changes, though not unprecedented except in scale – any education provider is certain to have one question rising above all others in their heads. Even if the suggested transformation is desirable, sensible and laudable, a key issue remains: is it affordable? In this section, we will attempt to answer that question.

In order to do so, we will offer examples of low-cost implementations of similar measures already in place. We will demonstrate the long-term view of "return on investment," demonstrating that it is financially imprudent to carry on with things as they are, especially when there may be costs associated with falling behind as others move forward. We will argue that increased spending may be most wisely used in teacher training programmes. Finally, we will briefly discuss the issues of public vs. private education and the potential for establishing public-private partnerships to move towards this kind of transformed provision.

Cost of existing implementations

What do existing implementations of similar change cost? Not necessarily very much. A great deal of the necessary change can be accomplished through the refocussing or redistribution of existing resources. As an example, it is worth noting that all education jurisdictions spend large sums on professional development for educators: it costs nothing to shift what is being taught in these training sessions.

In his 2009 book The Money Myth, University of California, Berkeley professor W. Norton Grubb demonstrated that leadership, instruction, and policies for tracking student progress are more powerful factors in school performance than financial investment. Grubb showed only the weakest of correlations between fiscal resources and educational outcomes.

We will demonstrate the affordability of radical change using three exemplar implementations of change in Colombia, Mexico and Canada.

92. Sahlberg, 2009, Educational Change in Finland, in A. Hargreaves, M. Fullan, A. Lieberman, and D. Hopkins (Eds.), International Handbook of Educational Change

93. OECD, 2013. "PISA 2012 Results: What Makes Schools Successful? Resources, Policies and Practices (Volume IV)," p 41

94. D'Orio, W. "Finland is #1!." http://www.scholastic.com/browse/article.jsp?id=3749880

Urban Schools   Rural Schools

68%   82%
2004   2011
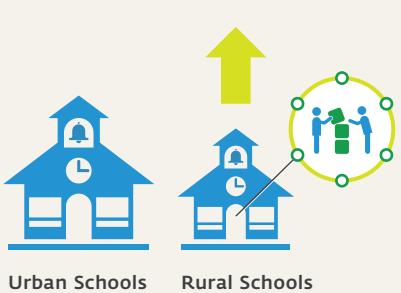
Escuela Nueva, Colombia

The Escuela Nueva programme was developed in the mid-1970s to cope with exactly the kinds of problems we are looking to counter – though only in primary education. Vicky Colbert identified the Colombian rural schooling system as a victim of weak relationships between schools and communities, low teacher morale, low learner engagement and high dropout rates, lack of learning resources (including teaching staff) and gender disparities, amongst other issues. She changed the teacher-led learning approach to one that was student-led, finding learning systems that encourage literacy and numeracy, create entrepreneurial, team-working and critical thinking skills, and advancement at a pace of each learners' choosing.[95]

Within a few years of its implementation in rural areas, the Colombian government recognized the transformative power of Escuela Nueva thanks to the fact that rural schools were outperforming urban schools. This was achieved without any significant financial investment, which no doubt was a factor in the Colombian government's decision to embed Escuela Nueva widely across the country. 20,000 Colombian schools now use the program; in the two years between 2007 and 2009, 700,000 Colombian children gained an education this way.
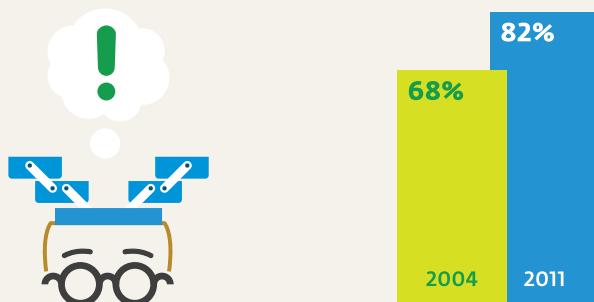
José Urbina López Primary School, Mexico

Our second example is in many ways a similar suite of low-cost innovations. José Urbina López school in Matamoros, Mexico, gained national attention when a shift towards student-led group work and self-directed learning resulted in one of its students gaining the country's highest score in a national math test, with a further nine students placed in the 99.99th percentile. Only 7% failed the exam, a figure that had dropped from 45 % before the innovations. Sixty-three percent were considered "excellent" in math. All languages scores were above the national average, with only 3.5% failing Spanish compared to the previous year's 31%.

This meteoric rise in achievement was made possible by a shift in teaching style, and a motivated, dynamic and risk-embracing teacher, but no financial investment. Though this is also a primary school example, there is no reason to think similar low- or no-cost improvements could not be achieved through similar pedagogical shifts in high school. Achieving better outcomes from education will involve investment in teachers, but need not involve capital investment. With student-directed learning and group work, and community involvement, it may be that the cost of teaching staff will fall overall. Costs associated with having administrative support staff design assessments and curricula should fall significantly.

Ontario Ministry of Education, Canada

Our third example comes from Ontario, Canada. An analysis of system-wide education reforms in the province, published by the International Academy of Education, suggests that cost is not a serious impediment to change.[96]

Ontario is a jurisdiction of 13 million people, including 2 million students. In 2004 it began a program of educational reforms that raised the number of students with "high" levels of numeracy and literacy from 55% to 70%. High school graduation rose from 68% in 2004 to 82% in 2011. The rate of teacher dropout fell significantly over that same period.

The IAE report highlights the fact that Ontario "was able to lever substantial change from relatively small amounts of funding." One of the contributing factors was that local leaders were given "more discretion over spending provided they had a good improvement strategy in place." The report notes that "better professional development, leadership development, or in-school coaching of teaching practice can all be supported with very modest increases in funding," and that putting measures in place to prevent high teacher turnover saves money. Being unable to pay decent salaries to sufficient teachers can be a problem, but "once a reasonable level of investment is reached, additional money is not the critical driver."

95. Escuela Nueva Model: http://www.escuelanueva.org/portal/en/escuela-nueva-model.html
96. International Academy of Education, 2012. "System-Wide Improvement in Education." http://www.iiep.unesco.org/fileadmin/user_upload/Info_Services_Publications/pdf/2012/EdPol_13.pdf

Public-private partnerships

There is no reason to think that the changes we are proposing in this document require a prohibitively large amount of fiscal support. However, we acknowledge that there may be a role for public-private partnership in the deployment of these ideas. The Internationals High Schools network, which operates schools in New York, California and Virginia, provides one example.[97] This network operates in innovative ways to help those who are not good English speakers to succeed in high school. The schools are successful, with progress report rankings putting Brooklyn International High School and International High School at LaGuardia Community College in the top 3% of high schools. They are part of the public school system and receive the standard amount of per pupil funding allocated by their local Departments of Education. There are funding partners involved, though, including the Bill and Melinda Gates Foundation, Bank of America, and many individual donors.

Another model is provided by the PEAS network of schools working in rural Uganda: they combine funding from the Ugandan government with financial contributions from a variety of sources such as Absolute Return for Kids (ARK), the UK government's Department for International Development and the Costa Foundation.

Return on investment

Changes that improve education are likely to prove prudent in the long term even if the short-term cost is higher. This section discusses the evidence for higher long-term payoffs. We strongly believe that there is also a moral case for making the suggested changes to learning programs across the globe, but we admit that, for those with responsibility for proper use of public money, the financial rewards may be a more compelling reason for action.

Higher salaries

According to UNESCO calculations, every dollar invested in education gives a tenfold return on investment.[98] In the United States, a high school graduate earns around 260,000 USD more

through his or her life than an early school leaver.[99] That results in approximately 60,000 USD more tax income and significantly reduced unemployment, welfare and public health spending. According to 2009 OECD figures, these differentials are also particularly pronounced in Hungary, the Czech Republic, Poland and Portugal.

We would also point out that the kinds of changes we are suggesting will lead to learners leaving high school education with skills and learning habits that render them well-equipped to thrive in the fast-changing world of 2030 and beyond. If the entire approach we recommend is taken up, it is likely that the emerging learners will be disproportionately better off, in terms of pleasing employers and gatekeepers of tertiary education, than peers who have completed a "business as usual" secondary education. To quote a Nokia manager: "If I hire a youngster who doesn't know all the mathematics or physics that is needed to work here, I have colleagues here who can easily teach those things. But if I get somebody who doesn't know how to work with other people, how to think differently or how to create original ideas and somebody who is afraid of making a mistake, there is nothing we can do here."[100]

Reduced crime

The kinds of transformations we are recommending will also have financial payback in terms of lower social exclusion, higher school completion rates, and thus reduced costs associated with crime.

A number of studies have found that staying in school makes young people less likely to be convicted of a crime or incarcerated. The causal relationships here are subtle, but a trio of Swedish researchers found in 2011 that one additional year of schooling decreases the likelihood of conviction by 7.5% for males and by 11% for females.[101] The benefits accrue across crime categories, reducing property damage and violent crimes, and improving quality of life for all citizens.

Being physically in school reduces the opportunities to be involved in criminal activity in the larger community, but there are deeper reasons why increased school engagement cuts criminal engagement.[102] To start, it creates better economic opportunities in the years after education.

97. Internationals Network for Public Schools: http://internationalsnps.org/

98. Education for All, 2012. "EFA Global Monitoring Report: Youth and skills: Putting Education to Work."

99. Rouse, C. E., 2005. "Labor Market Consequences of an Inadequate Education." Paper Prepared for the Symposium on the Social Costs of Inadequate Education, Teachers College Columbia University, October 2005

100. Sahlberg, P, 2012. Finnish Lessons, What Can the World Learn From Educational Change in Finland?. Blackstone Audio, Inc.

101. Hjalmarsson, R et al, 2011. "Can Education Policy Be Used to Fight Crime?." http://www.voxeu.org/article/can-education-policy-be-used-fight-crime

102. Tauchen, H et al, 1994. "Criminal Deterrence: Revisiting the Issue with a Birth Cohort." Review of Economics and Statistics 76, 399-412 (1994)

Stephen Machin, Olivier Marie and Snuck Vujic studied the outcome of a change to the legal school-leaving age in the UK. They found that the first cohort of British school-leavers forced by a change in the law to stay in school for an extra year were less likely to engage in criminal behavior than students who had left school at a younger age. In this scenario, the cost of schooling students for an extra year was offset by savings associated with reduced property crime, which makes up 70% of UK crime.

In the US, education has a clear effect on violent crime. A 2004 study by Lance Lochner and Enrico Moretti demonstrated a social benefit of about $1.4 billion per extra school year as a result of fewer violent crimes. The UK study put the benefit of an extra year's schooling at 38–50 million USD.[103] According to a 2004 study by Lochner and Moretti, increasing high school graduation rates by 1% in one year would have resulted in an estimated 100,000 fewer crimes in the US. That, they say, has a value to society greater than $2 billion – that is, $3,000 per additional male graduate.

Improved health

Improved education can offer further savings to society through improved health. According to the OECD "[there is] considerable international evidence that education is strongly linked to health and to determinants of health such as health behaviours, risky contexts and preventative service use. Moreover, we find that a substantial element of this effect is causal [...] Education is an important mechanism for enhancing the health and well-being of individuals because it reduces the need for healthcare, the associated costs of dependence, lost earnings and human suffering."[104]

Smoking incidence, for instance, is reduced by 10% per additional year of schooling.[105] Self-reported health is between 15 and 30% higher with an additional year of high school in the US.[106] It is worth noting that not all European studies show similarly stark improvements, and obesity outcomes are not

significantly changed by education. Nonetheless, Lochner offers a ballpark figure for the mortality benefits of an extra year of school, in terms of reduced healthcare interventions, of $1,500–2,500 per year.[107]

Investment in learning professionals

There will, of course, be areas in which our suggestions call for increased investment. The learning professionals involved in this new style of learning need to be high-calibre individuals and in this section we offer a very brief analysis of what that might mean in terms of cost.

Surprisingly, excellent teachers need not cost top dollar in terms of salary. Professional freedom may be a sufficient substitute. Finnish secondary teachers, for example, are paid an average of $38,601 after a decade in the profession, which is well below those in the UK, Spain, and the US. Nevertheless, the profession still draws top candidates, because Finnish teachers are given freedom to do their job in the way they see fit.

Teacher training costs vary enormously between jurisdictions and even between methodologies in one jurisdiction.[108] Pauline Musset points out that different countries require different teacher education programmes, and offers a useful survey, should the reader want to think more deeply about what would be relevant in their situation.[109]

Even if teacher-training costs do rise, this investment can be offset by financial gains for the learners. Stanford University's Eric A. Hanushek has estimated that "a good but not great teacher, one at the 69th percentile of all teachers rather than at the 50th percentile [...] produces an increase of $10,600 on each student's lifetime earnings.[110] Even a modestly better than average teacher (60th percentile) raises individual earnings by $5,300, compared to what would otherwise be expected." That raise applies to every student in the class. For that reason, Hanushek points out, a teacher at the 60th percentile will each year raise students' aggregate earnings

103. Royal Economic Society, 2011. "Cutting Crime Through Education: Evidence From British School-Leavers." http://www.res.org.uk/details/mediabrief/1452921/Cutting-Crime-Through-Education-Evidence-From-British-School-Leavers.html

104. Feinstein, L et al, 2005. "What Are the Effects of Education On Health?." www.oecd.org/edu/country-studies/37425753.pdf

105. Clark, D & Royer, H, 2013. "The Effect of Education on Adult Mortality and Health: Evidence from Britain." American Economic Review, 103(6), 2087-2120

106. Mazumder, B, 2008. "Does Education Improve Health? A Reexamination of the Evidence from Compulsory Schooling Laws." Economic Perspectives, 33(2), 2–16.

107. Lochner, L, 2011. "The Impacts of Education on Crime, Health and Mortality, and Civic Participation." http://www.voxeu.org/article/wide-ranging-benefits-education

108. Savage, J. "How Much Does it Cost to Train One Teacher?." http://www.jsavage.org.uk/ite/how-much-does-it-cost-to-train-one-teacher/

by a total of $106,000. "The impact of one at the 69th percentile (as compared to the average) is $212,000, and one at the 84th percentile will shift earnings up by more than $400,000." Though not all teachers can be above average, raising the level of the average teacher is certainly not a wasted investment.

Another result of investing in teacher training programmes is to reduce teacher attrition. A study conducted in Florida, US found that new-hire retention rates varied between 45% and 73% depending on school district. The district with the highest teacher retention rate was one that had a strong and supportive teacher induction and mentoring program.[111] Finland, too, has a high retention rate for teachers, with about 90% of trained teachers remaining in the profession for the duration of their careers.[112] This has been attributed to the autonomy, intellectual opportunities and trust afforded to Finnish teachers.

Costs of physical infrastructure

It is tempting to think that investment in buildings is an essential part of any school improvement plan. However, physical structures are not a central part of our improvements. Mexico and Colombia, for instance, have achieved major improvements in student outcomes without any expensive alterations to the physical learning environment. A technology infrastructure requires capital investment, of course, and as we noted in Chapter 3, digital technology is an extremely valuable tool for education. Where it is available and affordable, it makes sense for learners and learning professionals to access and use all such aids to learning. We would argue that our pedagogical approach will not be any more expensive than standard approaches to technology use. It will, however, put such capabilities to smarter use.

One physical infrastructure consideration we do recommend concerns the learners' physical safety. While some communities celebrate removing physical barriers between the school and the local community, in other contexts learners are far more secure and able to learn when they know they are not at risk of intrusion from outside. We refer the reader to the Learners' Charter of Rights found in the Appendix that declares a safe environment to be an essential prerequisite for fruitful learning. How that safety is established will vary depending upon context.

Conclusion

Though the cost of implementing our vision of learning will vary with geographical context, there is no reason to believe that it will be prohibitively expensive. Many innovations have been achieved at minimal financial cost, and investment in effective, learner-centered education will largely pay for itself by a variety of means, through society writ large, including including increased personal incomes and reduced costs associated with criminal activity or healthcare requirements.

109. Musset, P, 2010. "Initial Teacher Education and Continuing Training Policies in a Comparative Perspective: Current Practices in OECD Countries and a Literature Review on Potential Effects." http://dx.doi.org/10.1787/5kmbphh7s47h-en

110. Hanushek, E, 2011. "Valuing Teachers: How Much is a Good Teacher Worth?" http://hanushek.stanford.edu/publications/valuing-teachers-how-much-good-teacher-worth

111. Shockley, R et al, 2005. "The Relationships Between Demographic Variables and Teacher Retention: A Longitudinal Study." Paper presented at the Florida Educational Research Association (FERA), November 2005.

112. Center on International Education Benchmarking. "Finland: Teacher and Principal Quality." http://www.ncee.org/programs-affiliates/center-on-international-education-benchmarking/top-performing-countries/finland-overview/finland-teacher-and-principal-quality/

Implementation I

Introduction

There has been no shortage of successful experiments with educational innovation. However, many attempts that work well in limited pilot projects have fallen flat when attempts have been made to implement them on larger scales.[113]

In the introduction to this document, for example, we mentioned the disappointing implementation outcomes from the 1967 Plowden Report recommendations for primary education in England.[114] In 1987, author Bridget Plowden remarked that the problem was not in the vision, so much as in many aspects of its implementation.[115] Advice for implementation could be found in the report, Plowden notes, but was not visible enough. She acknowledged, for instance, the Report's recommendation that teachers 'must select those of our suggestions which their knowledge and skill enable them to put into practice in the circumstances of their own schools' was "not emphasized sufficiently." The phrase "in the circumstances of their own schools" illustrates the problem with reforms that are not system-wide.

Adrianna Kezar has provided a coherent analysis of literature on scaling up change in an educational context. She points out that we do not lack good ideas for improving instruction, but have innumerable examples of good ideas failing to "take" at large scales. She points out that scaling changes to K-12 education is particularly problematic.[116]

Kezar identifies two main problems. The first is that implementation models have largely ignored knowledge and understanding of successful programs for scaling change. The second is that, where they do adopt models for scaling, these are generally dated approaches that are not well aligned with the particular needs of education systems. They might, for instance, be borrowed from the international development literature.

In order not to fall into the same trap, we will in the next chapter attempt to use wisdom gained from analysis of successful implementations of wide-scale change in secondary education in order to lay out an exemplar pathway for implementation of the changes we are recommending. In this chapter, however, we will focus on the broader issues of successful scaling, sustainable change and the importance of global benefit being gained from any innovation program.

THREE SECRETS OF SUCCESSFUL SCALING

Local input

Reform plans can be developed internally by teachers and administrators in a school or externally by a developer such as a Ministry of Education. Both approaches have been associated with successful implementation in specific schools.[117]

There is some evidence that externally developed reforms are easier and less costly to implement and involve fewer risks.[118] The advantage of this is that the easier and less costly it is to implement a design, the more likely it is that reform will disseminate across large numbers of schools or classrooms. However, imposition of an external design has been associated with changes that do not last.[119]

Kezar notes that innovations that scale successfully alter the norms of teachers and other learning professionals, breaking their existing habits. Simply imposing change on their practices is not enough to alter established norms. In order to achieve lasting change, a program must be adjusted to suit the environment where it will be applied. That must be done in collaboration with the local stakeholders so that they are motivated to break their own, self-diagnosed unproductive habits.

There are two reasons for this. First, school reform efforts are much more successful when they are tailored to fit the particular school setting. It is challenging, for example, to impose innovations on schools in rural areas when they have been trialed exclusively in urban schools. An innovation should reflect needs that have been acknowledged locally. As researcher Andy Hargreaves has put it, consensus on the best way forward is "best secured not through the sole medium of written administrative texts, but through communities of people within and across schools who create policies, talk about them, process them, inquire into them, and reformulate them, bearing in mind the circumstances and the children they know best." [120]

The second issue is that this provides much better motivation for all involved. Teacher support is crucial for the success of any reform. If teachers do not support the reform, a situation that often arises if the district or principal has imposed it on them,

113. Fullan, M, 2009. "Large-Scale Reform Comes of Age," Journal of Educational Change, February 2009
114. Central Advisory Council for Education, 1967. "Children and their Primary Schools" ('The Plowden Report'), London: HMSO.
115. Plowden, B, 1987. "'Plowden' Twenty Years On." See http://www.educationengland.org.uk/documents/plowden/plowdenore-09.html
116. Kezar, A, 2012. "The Path to Pedagogical Reform in the Sciences: Engaging Mutual Adaptation and Social Movement Models of Change." Liberal Education, Winter 2012, Vol. 98, No. 1. http://www.aacu.org/liberaleducation/le-wi12/kezar.cfm
117. Glennan, T et al, 2004. Expanding The Reach of Education Reforms: Perspectives from Leaders in the Scale-up of Education Interventions," RAND Education.
118. Ibid.
119. Cody, A, 2013. "Is 'Scalable' a Code Word for Top-Down Reform?." http://blogs.edweek.org/teachers/living-in-dialogue/2013/02/is_scalable_a_code_word_for_to.html
120. Hargreaves, A. "Hargreaves on Education Policy." http://www.learningrecord.org/hargreaves.html

Large-scale changes cannot be considered successfully implemented unless they are able to survive evolution of the system and remain useful in a changing world.

they will often resist it or half-heartedly implement it, trusting from experience that the principal or district staff will eventually shift their attention elsewhere.[121]

Daniel H. Pink's *Drive: The Surprising Truth About What Motivates Us* lays out three motivators: being handed responsibility for the task, becoming better at something that matters to you and contributing to a cause greater and more enduring than yourself. For this reason, adaptation should be a flexible process that is negotiated between champions of change and the educators, parents, students and communities who will ultimately determine its success. A vital part of this process is for teachers, parents and caregivers, and students to be involved in design and implementation of change.

Global applicability through inclusive reforms

If a reform is to be scaled beyond a single institution, it must give a sense of progress to a community, not just for the learners within that institution. In other words, the changes must work for everyone in the community. Many strategies have improved the learning outcomes for 50–60% of students in a given jurisdiction. This is not our aim. We want to improve the outcomes for all students.

A recent OECD report indicates that broad-based change helps to reduce socioeconomic disparities. A commitment to equity within an education system can greatly diminish the correlation between family income and educational outcomes. There is also evidence that whole-school reform is more effective at improving instructional practice than reforms targeting a particular segment of the student population, a specific part of the curriculum, or only a few classrooms in a school.[122]

Schools implementing wholesale changes tend to experience greater improvements in instructional practice and in student achievement than schools targeting change to only a segment of the student population.[123] In describing the process of scaling up school reform in California, Honig argued that comprehensive, school wide reforms have a greater influence on classroom practice than do piecemeal efforts.[124] It seems worth pointing out that Finland's performance has been especially notable for its remarkable consistency across schools. There is little variation in outcomes between schools, and the gap between the top and bottom-achieving students in any individual school is small. Finnish schools seem to serve all students well, regardless of family background or socioeconomic status. We note that the much-lauded Finnish reforms were nationwide and wholesale, rather than targeted at particular groups.

When innovations are designed, the following questions should be considered:

- Do the proposed changes help learners of all abilities and motivations, including the most advanced learners and those with unique requirements for physically or cognitively accessing education?
- Is it accessible to learners of all socioeconomic groups in the local context?
- Are the required resources available to all of the jurisdiction's learners?
- Is the take-up of the innovation likely to be equally advantageous to people of either gender?

If the answer to these questions is yes, there is reason for hope that the measures will be scalable.

121. Datnow, A et al, 2002. Extending Educational Reform: From One School to Many. London & New York, 2002. Routledge/Falmer.

122. OECD, 2009. "PISA 2009 Results: Overcoming Social Background: Equity in Learning Opportunities and Outcomes Volume 2." http://www.oecd.org/pisa/pisaproducts/48852584.pdf

123. Stringfield, S et al, 1997. "Urban and Suburban/Rural Special Strategies for Educating Disadvantaged Children: Findings and Policy Implications of a Longitudinal Study."

Sustainability through support networks

Large-scale changes cannot be considered successfully implemented unless they are able to survive evolution of the system and remain useful in a changing world. A lack of sustainability was another shortcoming of the Plowden program, for example, a "rapid increase in the birth rate [...] meant a vast increase in the numbers of teachers needed," and "we could not in our comments on science envisage the use of computers."[125]

Sustainability is perhaps the hardest criterion to meet, since it requires both a degree of foresight and luck. However, change is not unforeseeable, and the strongest defense against obsolescence in the face of change is the establishing of a robust communications network for stakeholders.

Within this network, good practice should be openly and publicly debated on a regular basis. Individuals or groups implementing reforms should be connected to others involved in similar efforts where they can share practices – both successes and failures – and create learning communities where educators deliberate on education and flag up impending change and likely future requirements for learning. Sustainability is often improved by a system of accountability that allows for discussion of successes, disappointments and suggestions for future improvement while retaining focus on implementing change rather than finding excuses for failure.

The network should also channel the implementing institution's continuing support for those implementing the change on the ground, and provide a means for recognition and reward of achievements. Fullan has suggested that the role of a reform-seeking principal should include actively seeking out new alliances with external organizations, such as reform networks and potential funders to help facilitate this.[126]

There are several examples of networks supporting change in learning practices: the work of Collaborative Impact and Todos Pela Educação would provide a good starting point.[127] Collaborative Impact is a change brokering organization. It runs the New Pedagogies for Deep Learning project, which is connecting various stakeholders in education in order to enable them to work better together towards providing enhanced teaching and learning opportunities. Todos Pela Educação (TDE) is an NGO that pulls together educators, students, entrepreneurs and administrators to work towards giving all Brazilian children access to a quality basic education. By creating strong links between stakeholders such as government education departments and those managing education resources in schools and communities, and bringing external expertise and resources where needed, TPE is creating the opportunity for education provision to reach those it would never otherwise have reached.

Having laid out the general considerations for implementing scalable, globally applicable and sustainable change in education, we will now go on to look at specific paths forward.

124. Honig, M, 1994. "Bridging the School-to-Work Divide."

125. Plowden, B, 1987. "'Plowden' Twenty Years On." See http://www.educationengland.org.uk/documents/plowden/plowdenore-09.html

126. Anchan, J, 2002. Change Forces in Post-Communist Eastern Europe: Education in Transition. Routledge Falmer. London & New York.

127. Collaborative Impact: http://www.collaborativeimpact.net; Todos Pela Educacao: http://www.todospelaeducacao.org.br/
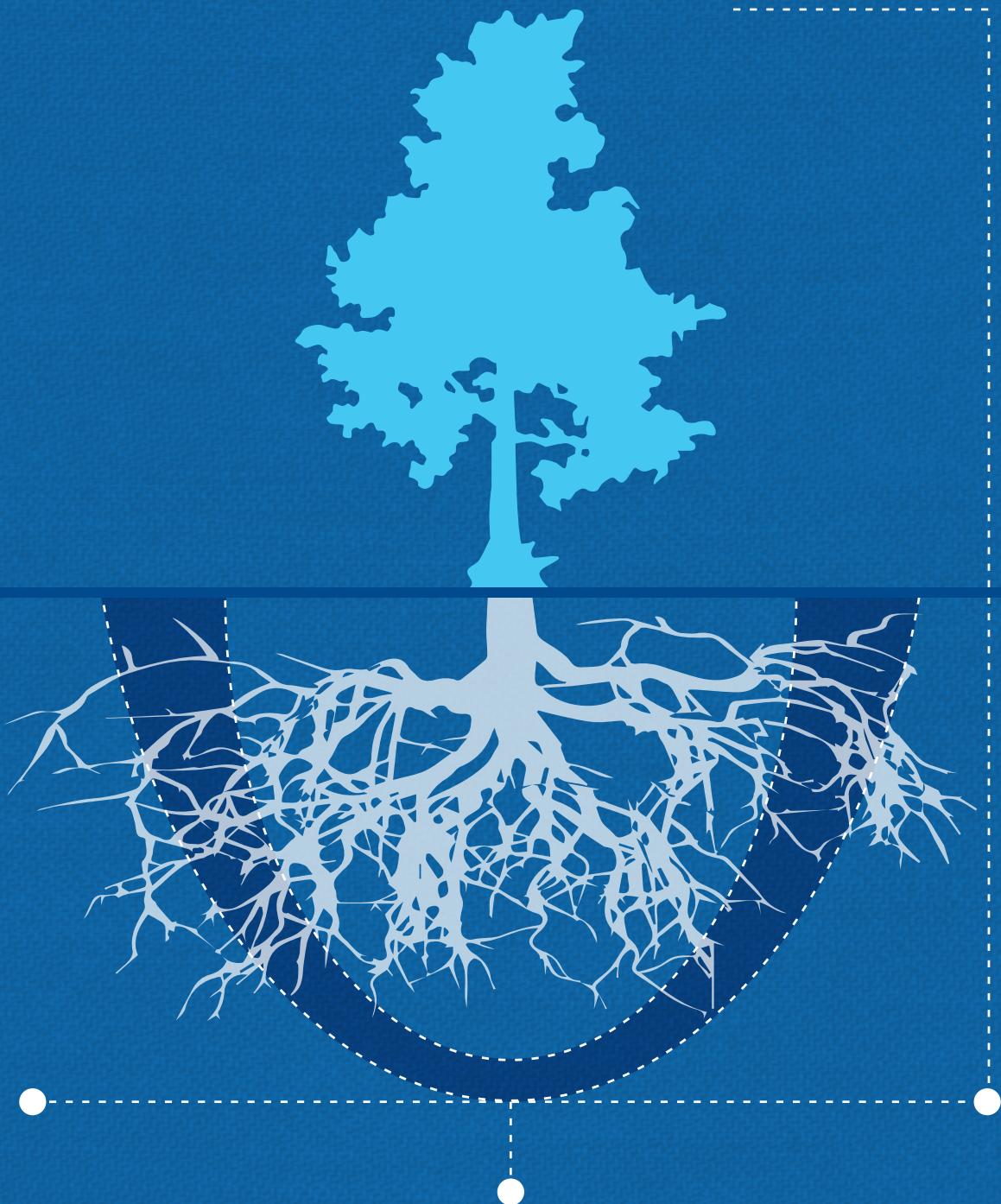
Implementation II

Introduction

Implementing significant change is a once-in-a-generation activity. A partial success leaves little room and resources for a "second wave" that fills in the gaps. As we noted in Chapter 8, flaws in implementation mean that many big-ticket programs have produced limited results – sometimes none. This is why we want to give careful consideration to implementation of our recommendations, limited as we are by our commitment to keeping geographical, cultural and political considerations as broad as possible.

As we have mentioned, the kinds of changes we are recommending are already being implemented in various places, but usually only in a single "alternative" school rather than on a broader scale. Scaling implementation requires careful consideration and planning if we are to achieve lasting, system-wide improvements. To this end, we will now lay out the important considerations for the implementation of these kinds of changes in an education context, followed by a suggested example pathway.

General considerations for a pathway to change

There are many models of implementing change. We will build here on one developed by Harvard Business School professor John Kotter, more fully explored in his 1995 book *Leading Change*. We have chosen Kotter's model because, of the best models, it seems the easiest to adapt to the issues of implementing system-wide change in education. Our aim is not to be prescriptive, but suggestive, bringing out salient points that should lead any discussion.

To create lasting change, Kotter says, it is necessary to:

1. **Create urgency** – an incitement to aim higher than "business as usual," and aim higher now. It involves transmitting the recognition that the world is changing fast, and that opportunities are opening up for our community of children. Fostering community conversations through the media, existing schools and social networks is an essential part of the preparation. Kotter's view is that we should aim to bring around three-quarters of the "management," in this case, stakeholders such as parents, media, teachers and school and community leaders, onside by this process before proceeding to step two. Note: negative motivations – that learners are now being disadvantaged by our inaction – are to be avoided, if possible.

2. **Form a powerful coalition** – not necessarily gathering those with existing power, but assembling a team of people who have skills, respect, charisma, motivation and political influence – and have bought into the vision for change. The team members should be from every area and level of the organization. That means teachers, parents, community leaders, etc., as outlined above.

3. **Create a vision for change** – lay out a clear, easily communicable and memorable vision of what the change will achieve. It can be summarized in one or two sentences, and will be the take-home message from, say, media reports and consultation meetings with parents and community leaders. The coalition will then create a strategy to bring that vision to reality.

4. **Communicate the vision** – it is important that the vision be transmitted within the learning community as well as outside, and spoken about in everyday situations rather than just in specially-arranged meetings. At this stage, old-style values must be invisible. Preparing for the exam-free future, for example, means celebrating local learners' exam results as an indicator of how ready learners are to embrace the future, how well they learn, and how that facility for learning will soon be creating even brighter futures for them. Training and reviews of learning professionals' performance should begin to reflect this future context too. Note: at this stage, people will voice their concerns about the proposed changes, and these concerns must be sensitively, empathetically and comprehensively addressed.

5. **Remove obstacles** – at this stage, the coalition should be hiring "change leaders" whose role will be to identify specific implementation strategies, check for barriers to change (and remove them if possible), reward those who are making change happen (but not punish those who have not yet bought into the vision) and continue the process of persuasion towards uptake of the vision.

6. **Create short-term wins** – the coalition must create visible successes that are impossible to dispute, and achievable before it can be claimed that the desired change has failed to appear or is impossible to achieve. This requires the identification of a slew of short-term targets. When made public, these wins can provide an invaluable boost in motivation for all concerned. Examples might be an improvement in (appropriately measured) student

engagement or a reduction in absenteeism or dropouts within three months of the program's first implementation; another could be a collation of letters of support from local people, or an increase in applications for teacher training places. They must be carefully chosen to limit the potential for them to "backfire" and be used to undermine the process of change.

7. Build on the change – system-wide change is a long-term project and early successes do not mean victory is assured. Scaling up initial projects is an essential part of the second (and third and fourth…) wave that moves towards completion, and has its own challenges. It is important to review and refine changes that have been implemented in order to prevent amplification of once-small problems when the changes are scaled up. Vigilance is the watchword here. Reviewing the project's goals, and setting new ones is also important. Keeping change leaders fresh helps – bringing in new people, moving people into a variety of roles over time, for instance. This ensures no one stagnates or runs out of ideas, and that motivation keeps change rolling forward.

8. Anchor the changes in the culture – once the mountain has been climbed, there is real danger of slip and fall. Vigilance must be maintained. Even those people brought in to the system after the changes have been established must be given the opportunity to recognize what has been achieved and must buy into the vision even after it has been realized. The key leaders of change should be recognized and celebrated to give motivation and aspiration to future change-leaders within the organization. The story of success is important, and should be regularly re-visited.

Having outlined these steps, let's see how they might apply in the system-wide improvement of learning.

An example implementation pathway

Throughout this Blueprint we have endeavored to avoid prescription, since we are speaking to a wide variety of geographical, cultural, and economic contexts. Applying what we have recommended will require further thought and planning in each jurisdiction. However, taking into account change management wisdom and the experience of successful system-wide change implementations, here is what a typical implementation pathway might look like in 10 steps:

1. Identification of the ideal scale of implementation – including goals, scope and timespan. Once this has been identified, a conversation with media should begin;

2. Announcement of vision – coupled with an announcement of a long-term commitment of an appropriate sum of money for, say, 10 years in conjunction with a media engagement program to explain the vision and set out fora for public involvement and buy-in;

3. Publication of a set of goals – including justifications, assessment criteria, milestones and financials such as likely cost and source of funding;

4. Recruitment of human resources – to instigate the program of changes;

5. Development of recommended curriculum elements – by a sub-group of appropriately sourced learning professionals, community members, learners, higher education representatives and employers;

6. Design and implementation of the required teacher training programs;

7. Formation of stakeholder groups – to support the new learning system, together with a public awareness program to share vision of imminent change for the better;

8. Creation of protocols for system monitoring – including assessment, feedback and improvement.[128]

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128. Lessons learned from the successful implementation of change in Ontario are outlined in the International Academy of Education report "System-Wide Improvement in Education": http://www.iiep.unesco.org/fileadmin/user_upload/Info_Services_Publications/pdf/2012/EdPol_13.pdf; "Finland: Slow and Steady Reform for Consistently High Results," an OECD analysis of the way change was implemented in the Finnish education system can be found at www.oecd.org/pisa/pisaproducts/46581035.pdf

9. Reassessment of human resource requirements –
    followed by a second wave of recruitment and training and
    creation of networks for sharing ideas and achievements;

10. Implementation of a pre-launch review – that considers
    the following questions:

    • Is the desired change clearly defined? How complex
      is it? How difficult is it?
    • Are the key change-makers fully committed to the
      program? How skilled are they? Do they have the
      necessary resources in place? What is the nature of the
      support system, what are the competing demands on
      attention, and have they been minimized? [129]
    • Is the top level (for example, but not necessarily, the
      ministry of education) able and equipped to lead and
      support the work? [130]
    • Is there community support for change?

11. Program roll out – if the answers to the review questions
    are satisfactory, and communication and support
    networks are in place.

Living Blueprint

As a further contribution towards making these changes
sustainable, WGSI is instigating an online Living Blueprint
that mirrors this document but can be updated to reflect
new learning, experiences and challenges. In line with our
findings on sustainable change, we feel it is important that
the recommended measures evolve. As Andy Hargreaves puts
it, "detailed documents that freeze policies in text become
outdated and overtaken even as they are being written, by
changing communities, new technologies, fresh legislation,
research insights, and unanticipated problems." [131]

The Living Blueprint *(learning2030.org)* is an attempt to
unfreeze our recommendations. We would like those who
share our vision, and decide to act on it, to join with us in
networking to ensure wide access to the emerging knowledge
and skills that will significantly enhance learning in 2030.

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129. Establishing policies, accountability measures and limited professional development is not enough. The Ontario strategy was to employ 200 people at the Ministry who linked to a leader in each of 72 school districts and to the teams leading implementation in every school. This took 1% of the elementary and secondary budget

130. This requires consideration of the characteristics of an effective ministry, laid out in the Appendix of the IAE report

131. Hargreaves, A. "Hargreaves on Education Policy." http://www.learningrecord.org/hargreaves.html

Conclusion

There is, according to education researcher Michael Fullan, "something different about 2014."[132] Fullan has been working on educational reform for 50 years and at this moment, he says, we finally have an opportunity to make significant change happen.

He is not alone. Worldwide, there is a growing sense that a new commitment to change has materialized. Perhaps it is the result of businesses recognizing that their recruits aren't able to do the tasks required of them in the 21st century. Perhaps higher education institutions have found themselves squeezed and embarrassed, with their graduates encountering difficulties in the workplace and their undergraduates unable to cope with the academic demands placed upon them. In certain places, even governments and national education chiefs are admitting that their systems are failing to deliver the kinds of education that work well in the globalized world of 2014.

This report has been an attempt to address those concerns and point out an educational path that is now open to us. Many have been aware of this path for decades – though it has largely been inaccessible, they have seen glimpses of what it offers. Others knew nothing of it but, when it is pointed out, recognize its solutions as realizations of their own leanings and inclinations.

It really doesn't matter who saw this path first. The point is, in 2014, we can finally embark on it together. There is good reason to think that we can impact the well-being of a generation using changes that are well-defined, affordable and implementable. We know enough about how learning happens (and doesn't) to make recommendations for change. We know enough about how educational change happens (and doesn't) to embark on making a difference immediately.

While Learning 2030 is the focus of this Blueprint, we must lay the foundation for this vision now. What we have now isn't working – not if our goal is to fully prepare high school

learners for their lives. Even where it is working to some degree, its efficacy is falling fast as the 21st century unfolds. We do, however, have a good grasp of what works better. We know that certain standard practices, particularly high-stakes summative assessment, are destructive and problematic, and must be removed. We know that we must move away from fact-based learning towards the development of skills and habits associated with flexible, agile lifelong learning. We know that autonomous, high quality school leadership, and well-trained, autonomous, trusted teaching staff are central to achieving this goal. We know that we can – and should – start now.

Implementing these changes requires local commitment and large-scale action on the part of educators, administrators and principals. It will not be straightforward. It will, however, be worth it. This is the kind of action that will eradicate the disparity in learning outcomes between students from different socioeconomic groups. It will move education away from being a zero-sum game, where there are winners and losers, to being a win-win. It will enable future generations to resolve many of the global issues that so desperately need creative solutions, such as climate change and energy production.

Finally, we want to reiterate that this document is not the final word; it does not contain all the answers. It is designed to be a catalyst for change – and will form the basis for the development of an online repository of dynamic resources. We welcome suggestions for where gaps can be filled, and where useful case studies can be added.

This is the start of a journey. We hope you join us.

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132. Fullan, M, 2014. "There is Something Different About 2014." http://www.michaelfullan.ca/there-is-something-different-about-2014/

Appendix

Learners' Charter of Rights

Learners have a right
to access good education.

Learners have a right
to feel safe.

Learners have a right
to fail safely.

Learners have a right
to progress at their own pace.

Learners have a right
to self-assessment.

Learners have a right
to mentorship.

Learners have a right
to create content.

Learners have a right
to personalized, flexible support.

Learners have a right
to define their goals.

Learners have a right
to social collaboration.

Learners have a right
to academic collaboration.

Learners have a right
**to physical, mental and
emotional wellbeing.**

Participants

Iyinoluwa Aboyeji
/ CEO, Fora

Iyinoluwa Aboyeji (better known as simply "E") is very passionate about people, ideas and technology. "I get a special thrill from connecting with people and ideas that can change the world," says E. His dream is to enable every young African to access a higher quality education. In E's home country of Nigeria for example, 75% of 1.7 million university applicants are turned away because there are no spaces for them.

A recent graduate of the University of Waterloo, E is the CEO of Fora, an education startup that provides Africa's leading universities and corporate bodies with premium educational content developed by professors at the world's best universities; making it possible for these organizations to raise the quality of education and training they offer to their students to a level similar to that obtainable at some of the world's best universities for less than 10 times the cost.

By 2030, E hopes that increased access will have led to improved quality in education in Africa. "Fora won't be necessary then, we're working to put ourselves out of a job," he says.

Noora Al-Thani
/ Al-Bairaq Team Leader, Qatar University

Noora Al-Thani heads a program at Qatar University to give high-school students an opportunity to do hands-on research with university scientists and engineers. The program, known as Al Bairaq, is open to all students, not just the elite. "Any student who wants to join us is welcome," she says. "We don't choose the student."

Participating students spend one to three months working in small groups on a research project, guided by mentors at the university. So far, subjects have included the science of sport, nanotechnology, polymer science, and composite materials. Noora is a biophysicist, but the program stresses interdisciplinary research that can cover any and all STEM subjects. At the end of their research, the students present their results to an audience that includes representatives from industry and the government.

Students have flourished in the program, she says. "Learning through hands-on activity is the strongest way to learn."

Noora hopes more education looks like this by 2030. "Students are very clever, but we need to bring a new way to get them involved with us," she says.

On the side, Noora is passionate about conservation of the wild plants of Qatar and has published an award-winning book (in both English and Arabic) on the endangered Ghaf tree.

Graham Brown-Martin
/ Founder, Education Design Labs (EDLabs)
/ Founder, Learning Without Frontiers (LWF)

Graham Brown-Martin has had a largely do-it-yourself education. Expelled from school at age 15 for what he describes as "entrepreneurial activities with organic chemistry", he has been variously a software developer, punk musician, and multimedia entrepreneur during the dotcom boom. "I was very wealthy for about a nanosecond, and then I wasn't," he says.

In 2005, he founded Learning Without Frontiers, an NGO to foster the use of digital technologies in education. Earlier this year he left to found a new venture, Education Design Labs. He is now in the midst of a world tour to study the implementation of digital technology everywhere from Silicon Valley to western Africa.

Graham feels that until now, digital learning has largely failed, because its users have lost sight of the big picture. When designers fashion a new consumer product, their first questions are always who the product is for, and what it's supposed to do. Educators don't ask those questions, he says – but they should.

By 2030, our mobile devices are likely to be so powerful that they can do things we can't even imagine today, and the educational system will have to take that into account and stress how to make wisest use of that power. "As we have more technology, education will have to become more about humanity and developing our consciences," he says. The real innovations, he suggests, may come from developing countries, not rich nations.

On a personal note, Graham has an extensive collection of toy robots, including – for Dr. Who fans – an armoured Dalek.

Greg Butler
*/ Founder and Partner,
Collaborative Impact*
*/ Former Senior Director for Global
Education Strategic Partnerships,
Microsoft Corporation*

Greg Butler has extensive experience at every level of education, having worked as a teacher, school principal, and educational researcher, as well as working for the education department of New South Wales, Australia, and heading Microsoft's Partners in Learning initiative.

Through the innovation-brokering enterprise he founded, Collaborative Impact, Greg is involved in organizing a global partnership called New Pedagogies for Deep Learning. This project draws support from academia, governments, NGOs such as the Gates Foundation, and corporations such as Intel, Microsoft, Promethean, and Pearson. The project's goal is to radically transform 1000 schools in 10 countries around the world to take account of new learning technologies and the new environment that education finds itself in.

Greg wants to take the best of what we know and transform education into something far better. "It's not a matter of making a better mousetrap, refining the system," he says. Today's model of education was created when information was scarce and centralised – but the Internet has changed all that. In fact, many students now do their best learning out of school through their electronic devices, while school becomes a place of boredom and disengagement. Teachers feel it, too – their job satisfaction has plummeted to levels rarely, if ever, seen before.

By 2030, Greg hopes that education won't look anything like it does today. "I hope that learning isn't about schooling," he says. "It's something we do all the time, and we have smart tools and processes to support that."

When he's not working to reform education, Greg loves to be out on the roads on his motorbike. "That's my adrenaline rush," he says.

Andy Chandler-Grevatt
*/ Teaching and Research Fellow, School
of Education, University of Sussex*

Andy Chandler-Grevatt is a teaching fellow in Education at the University of Sussex, UK. His passion is to improve the way schools assess students' progress. Far too often, he says, assessments are just a simple judgement, or grade. "Students generally expect teachers to judge them," Andy says. "We have to change those attitudes. The relationship between teacher and pupil has to become more refined – sort of a 'critical friend' model."

For that to work, school curricula must also be designed with a clear progression of concepts that students can be measured against. "I think this moves away from the target-driven, number-crunching assessment to a much more profession-based judgement, thinking about what this child needs next rather than needing to pass an exam," he says.

To that end, Andy has written or co-written more than 25 books and curriculum guides to help science teachers in the UK assess students' deeper understanding of the subject rather than just their memorization of facts. In particular, he focuses on what he calls "troublesome knowledge" – concepts that are difficult to understand but, once mastered, open the door to many additional concepts.

Andy's vision for 2030 would be a school system that is much more evidence-based in its teaching methods, one that looks at the learning process holistically and structures schools to enhance that.

When he's off duty, Andy can often be found outdoors. "When I'm not doing education, I'm out in the garden, doing country walks, and things like that," he says.

Guilherme Cintra
/ Venture Capitalist, Gera Venture

Guilherme Cintra is an analyst for Gera, a Brazilian investment company that is working to develop high-quality private schools for reasonable prices. Trained as an economist, he worked first in the financial industry, but found that unsatisfying. Gera allows him to apply the same skills to meet a critical need.

For the past few years, Guilherme – who is only 22 years old – has taught classes to give economically disadvantaged students the learning skills they need to escape a failing public school system and get into better schools. At Gera, he has surveyed the country to find the best ways to efficiently provide such students with a better education.

"We're trying to change the way people manage schools in Brazil," he says. In particular, Gera wants to make teachers and schools more accountable for their results – but to make that work, Guilherme says, teachers need better training and feedback so they know how they can improve.

It's not enough, for example, just to put an iPad into a teacher's hands. "You've just got a really expensive tool," he says. Using technology wisely calls for the right software, such as apps that make math skills into games for elementary students – and, more important, teacher training to make the best use of the tools.

By 2030, Guilherme hopes that education will make better use of collaboration between students. "It's not only about you and your books, but what you can share with other people," he says. "I think that's going to be huge."

Outside of work, Guilherme likes to spend time playing the guitar and ukulele.

Guy Claxton
/ *Professor of the Learning Sciences and Research Director, Centre for Real-World Learning, University of Winchester*
/ *Honorary Visiting Fellow, Graduate School of Education, University of Bristol*

Guy Claxton focuses on how to build more powerful learners: students who remain calm, confident, and curious as they face life's challenges and pursue their passions. That's what everyone says, he notes – but Guy, who co-directs the Centre for Real-World Learning at the University of Winchester, UK, has found a promising way to do just that.

He calls it "Building Learning Power", a simple and inexpensive way of transforming classrooms that has already been implemented with success by tens of thousands of teachers around the world. The key is to stress habits of independent thought, curiosity, and collaboration in students. Teachers treat learning as a set of habits to be developed, just like those that underpin physical fitness, and regularly ask students to reflect on which "learning muscles" are developing well and which still need work. Classroom activities value the learning process more than mere results, so that schools often display failed or partially complete projects on the walls rather than polished, finished products.

Cognitive scientists have proven that intelligence isn't a fixed quantity, but a trait that students and teachers can shape. "Lots of teachers need to know they're in the mind-stretching business, not the mind-filling business," Guy says.

Guy's many books on learning, creativity, and the mind include *The Learning Powered School*, *What's the Point of School?*, and the best-selling *Hare Brain, Tortoise Mind: Why Intelligence Increases When You Think Less*.

Guy has practiced Buddhist mindfulness for many years. "Buddhism is kind of a non-religion – a religion which centers absolutely around firsthand inquisitiveness into the nature of life and your own mind," he says. "Mindfulness practice strengthens the whole range of learning muscles."

By 2030, he says, "I would love to go into schools where the lunatics – I call them the 'learnatics' – have taken over the asylum. The students are running it, and teachers are adjuncts."

Kayla Cohen
/ *Founder, To Be Honest Theatre Club*

Kayla Cohen's path through formal education has been unconventional but one thing is certain: she's passionate about learning. Dissatisfied with the rigid structures imposed by the current system, she carved out her own path and thinks the system is ripe for disruption: "One of my long term goals is to challenge mainstream education system's values and conduct by presenting it with what I regard to be alternative, enlightened ways of learning." Kayla plans to do this through artistic platforms and, most critically, student initiated events.

By 2030, Kayla hopes school will be a center of exploration rather than competition; where curiosity triumphs over fear. She says "I want high schools to not be afraid of uncertainty or disorder, but to cheer the phrase 'I don't know', and to support risk taking and new initiatives. Also, information should be presented without bias and students should be encouraged to form and act upon their own understanding."

Pauline Dixon
/ *Reader, International Development and Education, Newcastle University*
/ *Research Director, E.G. West Centre, Newcastle University*

Pauline Dixon studies low-cost private schools as a promising alternative for education in developing countries. For the past 13 years, her research at Newcastle University has led her to walk through the poorest neighborhoods of the developing world, counting and studying every school she finds. She's learned that many children who are officially counted as unschooled are actually enrolled in unregistered private schools – very good news for the goal of universal education. Better yet, her

studies show that those private schools educate their pupils at least as well as official state schools. In countries with corrupt, underfunded state schools, the private schools often do significantly better. If parents pay for their children's schooling – even just a few dollars a month – that gives them the power to demand accountability from the school, she says.

Pauline also studies how to improve the quality of learning. "These kids are desperate to learn," she says. "Unfortunately, the pedagogy is rote learning." The best way to improve on this, she thinks, is not through teacher training, but through identifying the brightest kids in a school and enlisting them to teach their peers.

Education is unlikely to change much by 2030 if it remains largely a government-led system, Pauline thinks. "There's no innovation within a government system. School is a Victorian concept that we're stuck with, and we have to think outside that box. My vision would be that education is no longer 'schooling'."

Pauline swam competitively as a child and is a jazz pianist who won a young musician of the year award when she was 18. She lives in rural Northumberland in the north of England.

Nikhil Goyal
/ *Author, One Size Does Not Fit All*
/ *Speaker*

Nikhil Goyal is frustrated by the American education system. At 17, he wrote the book *One Size Does Not Fit All: A Student's Assessment of Education* to document his own experience as a high school student and take on an education system that he believes suppresses the potential of students by discounting their individuality and creativity.

Now 18, Nikhil aims to transform the system that he recently graduated from. In 2012, he was included in Forbes annual 30 Under 30 listing and in 2013, received the Freedom Flame Award for his work in education. He follows his own advice to "never wait for permission to do something remarkable" by travelling internationally to speak on education issues and appear as a media commentator.

"Can you imagine a student wanting to learn more when the end of the school day is over?" asks Nikhil. "I hope that's where we'll be in 2030. That's when we will know the system is finally working."

Erik Gregory
/ *Chief Field Officer, Pearson*

Erik Gregory has a background in children's educational television and now works for the Pearson Foundation, where he works on using mobile technology to deliver rich educational materials in an affordable way to teachers and students in poor countries worldwide.

The scourge of education in developing countries is "chalk and talk", Erik says. At Pearson, he's working to get teachers to stop standing in front of their class and move to the middle where they can help students learn instead of just talking at them. Pearson's BridgeIT program, for example, uses cell phones or other mobile devices to engage students in viewing video programming in math, English, and the arts, then preparing and sharing their own work as well.

Erik has just completed a world tour of education for the poor, in which he visited more than 20 countries and explored what works and what doesn't. "We wanted to ruffle up the feathers of education globally and find the best practices of schools that are doing great things for $5 or $15 a month," he says. This summer, Pearson opened schools in the Philippines that put these methods into practice.

If Erik could change one thing about education by 2030, he would work with universities to change their admission practices to favor students who know how to learn, rather than students who know a lot of facts. This will give high schools the freedom to teach in a much more creative way, he says.

For recreation, Erik likes a good philosophical debate. "If you see me in the halls, feel free to run up and challenge me to an intellectual duel," he says. "That's when I really know I'm alive."

Jennifer Groff
/ *Co-Founder, Centre for Curriculum Redesign*
/ *Vice President of Learning & Program Development, Learning Games Network*

Jennifer Groff is an educational researcher and designer who focuses on three aspects of innovation in education. As Vice-President of Learning at the Learning Games Network, she leads the development of digital game design for deeper learning. "Digital games have

the potential to be Trojan horses for innovation in education," she says. Their game Quandary, introduced last year, teaches ethical thinking by putting players in scenarios where they must make difficult decisions. Educational games also open the opportunity to assess students' learning in new ways that avoid the anxiety of formal exams.

Jen also studies how to build educational systems that are adaptable enough to meet the needs of our rapidly changing world. Jen was a researcher in an OECD study of 180 innovative schools in more than 30 countries worldwide to identify good ideas and examine how best to scale them up to national level.

Third, Jen is co-founder of the Center for Curriculum Redesign, an NGO that is working with the OECD, corporations, and national education ministries to explore new models for school curricula. The basic outline of school curricula today hasn't changed in more than a century, leaving students learning largely irrelevant skills like trigonometry and long division, while shortchanging important modern skills like financial literacy and statistics. Jen is the author of numerous frameworks for unblocking innovation in education systems, educational reform, and the "whole-mindedness" approach to teaching, and is one of 20 emerging arts education leaders contributing to the new book *20Under40: Reinventing the Arts and Arts Education for the 21st Century*.

By 2030, she hopes that students are equipped to drive their own learning journey, being able to easily access and engage in whatever next learning module is most pertinent to their own needs.

Jen is a Google Certified Teacher, and also holds masters' degrees in education from Harvard and the University of Delaware. She is also an avid field hockey player and is passionate about nutrition and holistic wellness.

Kaisa Hahl
/ *PhD Student, Department of Teacher Education, University of Helsinki*

Kaisa Hahl began her career in the banking industry, but became a teacher after she had children. Now she trains teachers at the University of Helsinki, where she is also a PhD student. In particular, she is involved in developing an English-language program for training teachers, to accommodate the many international students who now want to train in Finland because of the great success of Finnish schools.

Kaisa's research focuses on the multicultural issues that arise when students from diverse backgrounds study together using English as their common language. "That's something very important for teachers of today," she says. "Our student base is now so multicultural – not only ethnic cultures but also social, linguistic, and religious backgrounds. So intercultural competences are an important skill for teachers to develop."

Kaisa is also studying ways to bridge another "intercultural" chasm – the one between the sciences and humanities. Her new program puts student teachers on both sides of the divide together for most of their courses. Her hope is that this leads to greater cooperation and more interdisciplinary teaching once the students move out into the schools.

By 2030, Kaisa hopes the educational system will do a better job of accommodating different kinds of learners. "That's something I see in my own children. They're all different learners, and teenage boys, especially, get so bored in school. I strongly believe there are things we can change so they can be better activated," she says.

In her free time, Kaisa likes to run. "There's nothing like the runner's high," she says. "That's when I get my own time, when I can clear my head."

Kourosh Houshmand
/ *Past-Vice President Public, Ontario Student Trustees Association*
/ *Founder and President, Solar For Life*

Kourosh Houshmand is a former Student Trustee for the Toronto District School Board (TDSB) and Vice-President of the Ontario Student Trustees' Association Public Board, representing a collective 2.6 million students. He is a recognized student leader in Canadian public education and has been interviewed and published by over 120 major Canadian and international media outlets.

Kourosh is also the Founder and President of Solar for Life – an entirely student run not-for-profit organization that aims to provide access to clean and affordable energy to impoverished communities across the world through solar panels. Solar for Life also provides renewable energy education to underprivileged regions. The organization's preliminary project is in Montevideo, Uruguay.

Kourosh hopes to see a complete education overhaul by 2030. He says "We need to remove the hierarchy of math and sciences that were implemented by the industrial revolution to include creative arts, which are at the bottom right now."

Ed Jernigan
/ Professor and Founding Director,
Centre for Knowledge Integration,
University of Waterloo

Ed Jernigan has spent every July for the past three decades living and working with some of the brightest high school students in Canada. Jernigan heads the University of Waterloo's Shad Valley program, a summer enrichment opportunity that gives these exceptional students a hands-on experience of science, mathematics, engineering, and entrepreneurship.

Ed also directs Waterloo's undergraduate program in Knowledge Integration, an interdisciplinary program that stresses synthesis, communication, and creativity. He holds a PhD in electrical engineering from the Massachusetts Institute of Technology and was a faculty member in the Systems Design Engineering department at the University of Waterloo for three decades, including two terms as chair.

At the core of Ed's approach is finding ways to give students the challenges they need in order to grow. "You don't know what you're capable of unless you push yourself," he says. "The conventional school system doesn't typically challenge those students who are capable of more." He stresses the four C's that are central to the Shad Valley experience: challenge, creativity, community, and connections. Schools need to do a better job, he says, of building community among students, challenging them, and giving them the opportunity to fail without penalty.

By 2030, he'd like to see schools move away from the notion that education is job training, and toward the goal of teaching creative, critical thinking. In his private life, Ed is a recent grandfather, a juggler and a long-time recreational basketball player. After 40 years on the court, he's scheduled for hip-replacement surgery on the last day of the Equinox Summit.

Eric B. Kennedy
/ PhD Student, Consortium for
Science, Policy and Outcomes,
Arizona State University

Eric B. Kennedy is a PhD student at the Consortium for Science Policy and Outcomes and Arizona State University – a school recognized for its innovative approach to disciplines – where he is part of the Knowledge Systems Analysis project looking at how to improve the knowledge used to make policy, technological and economic decisions.

Eric is fascinated by the way people and groups of people work together, and particularly, how complex problems can be better solved in interdisciplinary settings. As a graduate of the University of Waterloo's Centre for Knowledge Integration, he is no stranger to working in many diverse areas at once. He has curated museum exhibits, coordinated Emergency Medical Services in both his undergraduate and graduate career, and has presented his research at conferences around the world. Eric recently traveled to Tasmania to work with the Tasmanian Institute of Agriculture.

"I believe we can build a better world through learning, listening, and earnest collaboration," says Eric. "And that means what count is the world we design together." By 2030, Eric hopes to be working in the public service or a think tank to foster collaboration between diverse groups.

John Kershaw
/ President, C21 Canada
/ Former Deputy Minister, New
Brunswick Department of Education

John Kershaw brings extensive experience with the workings of government. A strategic planner by training, he served for many years in the government of the Canadian province of New Brunswick, including 7 years as deputy minister of education. This gives him an understanding of how to bring good ideas to fruition in the real world. "I have a good sense of what makes government tick and how to move things," he says. "I can share with people what works and what I've found doesn't work."

Since retiring from government three years ago, John helped found C21 Canada, a non-profit organization that advocates for educational improvement. In particular, he feels that schools do not do enough to teach 21st-century skills such as creative, critical thinking, and collaborative working. "It's broader now than just working with others – it's working with others that may be halfway around the world and in a different culture," he says. That makes cultural awareness another critical skill.

C21 Canada also advocates for more engaging ways of teaching, since surveys show that a majority of Canadian students do not feel challenged by today's schools. To engage those students, lessons should couple theoretical understanding with practical applications that are relevant to the students' individual interests–a task that will require smart use of technology.

John's vision for 2030 is that schools will fully embrace the use of digital technologies in learning. "It empowers the student with the ability to access knowledge at their speed of learning. It's the number one game-changer in learning today," he says.

In his spare time, John is a triathlete who completed his first Ironman triathlon last year.

Gersande La Flèche
/ *Co-Founder, Kids Code Jeunesse*

Gersande La Flèche is the co-founder of Kids Code Jeunesse, a non-profit that resolves to introduce computer science, computational thinking and problem solving into Canadian elementary schools. Since the spring of 2013, Gersande met with university leaders, several Québec French and English school boards and educational technology specialists to create a pilot project that will begin in several Montreal public schools this fall.

One of Kids Code Jeunesse' most important goals is provide policy-makers with compelling evidence that it is not only possible but absolutely necessary to teach children how to code. Her own experience speaks volumes; although she created her first website at age 12, her first formal instruction in computer science wasn't until her first semester of university.

Now completing an undergraduate degree at Concordia University, she also works as a freelance designer, web programmer and IT specialist while teaching and facilitating the coding workshops that are at the core of Kids Code Jeunesse. "I think we'll be able to rebuild that aspect of pioneering and creative control that has been lost as services like Google have centralized the way we use the web. Let's reach back to those ideals of community and ingenuity, to foster the sharing of knowledge and, ultimately, power."

Samuel Levin
/ *Founder, The Independent Project at Monument Mountain Regional High School*
/ *Student, Oxford University*

Sam Levin is the founder of two innovative, student-centered programs at Monument Mountain High School – Project Sprout and The Independent Project. In its first summer, the community garden at the heart of Project Sprout provided over 1000 pounds of vegetables to local shelters and people in need. By the time Sam graduated, produce from the expanded garden and orchard was featured in three meals a week in his school's cafeteria and other schools in the region had embarked on similar gardening projects.

"I saw kids waking up at six in the morning to harvest potatoes. But I couldn't reconcile the commitment and passion I saw in the garden with the lack of enthusiasm and engagement I saw in the classroom."

The difference, Sam recognized, was stewardship – in the garden the kids had control, responsibility and ownership. With that in mind, he and seven other students embarked on the first year of The Independent Project, a student-run school-within-a-school. "The Independent Project's successes show us that giving young people more agency and authorship over their own education can unleash the hunger, curiosity, and passion for learning that is currently dormant in most students," says Sam, "And its failures can inform our attempts to design better schools for 2030."

Adrian Lim Lye Heng
/ *Principal, Ngee Ann Secondary School*

Adrian Lim Lye Heng is principal of Ngee Ann secondary school in Singapore, which is one of only 33 schools in the world to be given Microsoft's highest level of recognition for incorporating technology into learning. Despite that, much of what the school does is simple and straightforward. "It's really a very mindful use of technology, not using technology for technology's sake," he says.

The key to Adrian's success is teacher training, and especially empowering teachers to experiment with better ways to use technology in their classrooms. "We are a middle school that behaves like a university," says Adrian. "I treat my teachers as clinician-scientists. I challenge them to think about the technology and the teaching methods they use. They do research to bring the best methods into the classroom." His teachers have so much independence, he says, that he's often surprised by what they do. "I have lost count of the number of innovations in my school already," he says with pride.

Adrian has also worked hard to redesign the physical layout of classrooms – for example, by creating smaller whiteboard spaces scattered around the room to encourage students to break into small groups for problem-solving.

Adrian's vision for 2030 would be that schools apply social-media technologies to allow teachers to know individual students better, so that they can deliver a personalized learning pathway for every student.

In his spare time, Adrian loves to run and swim, and to learn new things. "I don't see myself as a principal," he says. "I see myself as an explorer, always trying to find new things to do."

Linda Ma

/ *Student, Australian National University*
/ *Australian Delegate, G(irls) 20 Summit 2013*

Linda Ma is a young visionary who dreams of seeing women in the Asia-Pacific region reach their full potential as leaders, teachers, writers, entrepreneurs, artists and businesswomen. She is particularly passionate about promoting education for young girls and her long-term goal is to open a leadership academy for young women in the Asia-Pacific region to enhance the lives of women world-wide.

"I want to combat patriarchal expectations upon women in the region and train girls to be the best they can be, and be leaders in countries where they typically wouldn't be perceived as leaders."

Linda hopes that high schools in 2030 will operate as institutions which are embedded within their local communities, and serve as a focal point for community life and organization. Yet she also envisions them as institutions with an extremely global outlook, as universities are today.

Michael Maccarone

/ *Science Teacher & Curriculum Specialist for Science, Upper School, Avenues: The World School*

Mike Maccarone is the science curriculum specialist at Avenues, an innovative private school in New York City that is intended to be the first of many such schools around the world. Before that, he taught for 8 years in the New Jersey public school system, where he helped guide a transition in high-school science teaching that changed the order of science subjects to teach physics first.

The transition required many science teachers to teach outside their comfort zone–and that yielded unexpected benefits, because teachers had to talk with one other about teaching methods much more than they ever had. "We found that all of our teaching improved," Mike says.

That experience led Mike to do graduate work on developing a more integrated science curriculum, which he is now implementing at Avenues. His goal is to break down the walls between traditional biology, chemistry, and physics to make the courses more open to wide-ranging ideas. "We can teach a science class that really mirrors what scientists do," he says. "We can teach all the same content, but we can also teach the skill of thinking more wholly about the subject and what the solutions might be."

Mike's vision for education in 2030 would have teachers taking best practices from around the world, but applying them in ways that suit the local needs of their own students.

Mike's interest in science grew out of his passion for music. He plays guitar, marimba, xylophone, bass guitar, piano, and saxophone. "A little bit of everything," he says.

Sanjoy Mahajan

/ *Associate Professor of Applied Science and Engineering, Olin College*
/ *Former Curriculum Director, African Institute for Mathematical Sciences*

Sanjoy Mahajan thinks schools teach science and mathematics the wrong way round. Instead of focusing on precise calculation in the beginning, schools should teach rough-and-ready approximation first, to give students a feel for comparative quantities. "The uncompared number is not worth knowing," he says.

Sanjoy, a theoretical physicist who until recently headed the Teaching and Learning Laboratory at the Massachusetts Institute of Technology and now teaches at Olin College of Engineering, has been using this approach with students for nearly 20 years, and many former students later tell him it's the most useful thing they learned. He also describes his approach in his book, *Street-Fighting Mathematics: The Art of Educated Guessing and Opportunistic Problem-Solving*.

Searching for ways to come up with approximate answers forces students to understand the patterns and concepts behind what they learn instead of just memorizing facts. For instance, Sanjoy likes to demonstrate how he can roughly estimate the fuel efficiency of a jumbo jet by timing the fall of two conical coffee filters of different sizes. In the process, students have to make educated guesses about the relation between drag force

and velocity, estimate the speed of the jet, and bring in other bits of knowledge about the world. "We can make physics and math teaching much more effective and interesting," he says.

Earlier in his career, Sanjoy served as the first curriculum director of the African Institute of Mathematical Sciences, where he designed a one-year postgraduate curriculum that stressed understanding rather than memorization and problem-solving rather than formal lectures. By 2030, he hopes that high schools, too, will stress insight rather than memorization.

Outside of work, Sanjoy likes to cook and play the piano.

Lenny McKay
/ *Student, Asper School of Business, University of Manitoba*

Lenny McKay currently studies management at the University of Manitoba's Asper School of Business and is a student member of the Aboriginal Business Education Partners program. He has won entrepreneurship and business awards through his academic career and recently assisted with the development of a Canadian Aboriginal Business textbook through the Purdy Crawford Chair in Aboriginal Business Studies at Cape Breton University's Shannon School of Business.

Currently, Lenny works for the Business Development Bank of Canada, the organizers of the E-Spirit competition, with the hopes of giving back to the competition and the organization that has helped him realize many of his goals. Through the BDC, he has worked to improve the teaching modules used by the facilitators to better educate Aboriginal students on the fundamentals of entrepreneurship.

By 2030, Lenny would like to see the tools and capacity to deliver high-quality education is available to as many students as possible, especially those living in remote or isolated communities. "I would like to see advancements in technology that are able to overcome the logistical and monetary challenges of delivering quality education to in these communities," says Lenny.

Christine Mcwebb
/ *Director of Academic Programs, University of Waterloo, Stratford Campus*
/ *Associate Professor, French Studies, University of Waterloo*

Christine McWebb is director of academic programs at the University of Waterloo's Stratford campus. Though her training is in Medieval French literature, Christine's main focus in the past few years has been on creating and running two interdisciplinary programs in digital media at Stratford.

The programs, at the undergraduate and graduate level, combine fine arts, humanities, and technology to address challenges in the real world of business. Students work closely with industry partners such as Google, banks, retailers, arts organizations, and nonprofit companies to create user-friendly interfaces between people and their electronic devices.

Unlike most such programs, which live in business schools, Waterloo's programs are based in the arts and humanities and draw heavily on humanistic disciplines. "Things like visual literacy – how to really read signs and images, how to analyze signs and images," Christine says. "And also the creative side."

This experience gives Christine a valuable perspective on the importance of connecting education to the wider world, bringing students into direct contact with the ways their learning will be applied in real life.

Christine's vision of education in 2030 emphasizes depth of analysis and understanding. "What I would really like to see is an increase in readings of a longer nature – more literature – and to really ask the students to engage critically with longer texts," she says. At the same time, she warns against the risks of overspecialization and hopes that education will stress flexibility and integrated learning.

In her spare time, Christine loves to travel, especially to Europe. And also, she adds, "I am an avid reader, that's kind of self-evident."
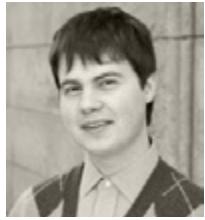
Chris Olah
/ *Thiel Fellow, Inventor and Hacker, hacklab.to*

Chris Olah is a 2012 Thiel Fellow with a self-confessed obsession for mathematics and 3D printing. These passions cross over at hacklab.to, a space where soft- and hardware hackers share, develop and collaborate on new projects. Chris contributes to hacklab as a 3D enthusiast, member and director of the organization.

Hacking education was a necessity for Chris. By the end of grade nine, he had read all of the grade 12 science textbooks and by the end of the following year, he was participating in a mentorship program at the University of Toronto, writing ecological modeling software and spending his spare time auditing courses.

By 2030 he hopes to see many things change. He hopes that gifted students will be empowered to seek out quality learning environments. He also hopes that genuine math education will replace memorization, and that programming will be realized as something as essential as literacy.

His advice? "You are capable of learning and doing remarkable things right now."

Susan Opok
/ *Uganda Managing Director, Promoting Equality in African Schools (PEAS)*

Susan Opok directs the Ugandan operations of PEAS (Promoting Equality in African Schools), an NGO that works to give all African children access to affordable, high-quality secondary education.

Now that many African countries try to provide universal primary education, secondary schooling has become the biggest bottleneck in the educational pipeline. Uganda, for example, now gives primary schooling to more than 90% of its children, but few of those can afford to go on to secondary schools. PEAS addresses this problem by building and staffing new private secondary schools in underserved areas and making sure they have the income – from government grants, student fees, and school-based farms and other initiatives – to keep tuition costs low. It's working: PEAS schools welcome students from disadvantaged families, yet their students often perform better than the national average on government tests.

Susan's goal is not just to provide school facilities, but also to improve the quality of learning. To this end, she and her team have explored how changes to curriculum and teaching methods can help students take a more active role in class – especially girls, who often tend to be passive observers in conventional classrooms. She also works hard to engage parents and the wider community in appreciating the value of secondary education for boys and girls equally.

By 2030, Susan hopes to see a bigger change in the educational system. In Uganda today, education focuses closely on the information students need to pass exams. "Getting information takes children away from getting knowledge," she says. Schools of the future, she hopes, would put more emphasis on critical thinking and skills development, so that students would be better prepared to use what they learn.

When she's not at work, Susan likes to swim, read novels, and spend time with family and friends. "Enjoy life," she says. "Life is short."

Zainab Ramahi
/ *Co-President, Knowledge Integration Student Society, University of Waterloo*

Zainab Ramahi knows how to seize the moment. She is pursuing a joint honours undergraduate degree in Knowledge Integration and Political Science with a minor in History at the University of Waterloo. In 2010, while still a high school student, she was named one of the Waterloo Record's 40 Under 40 and currently serves on the boards of the YWCA-KW and Muslim Social Services.

Over the past year, Zainab has worked with senior teachers and members of the school administration at the American School of Palestine (ASP) in West Bank, to challenge the borders of scholarship at ASP and to encourage students to champion their own learning. Zainab is the project architect for Studio Impact, a curriculum development project that aims to train diverse groups of middle and high school students that have been identified as 'disengaged' in the language of systems thinking and community-oriented citizenship.

"By 2030, I hope students develop an understanding of how they fit into and can affect change in their local and global communities," she says.

Ian Scholten
/ *Student, Centre for Knowledge Integration, University of Waterloo*

Ian Scholten is in the midst of a joint honours degree in Knowledge Integration and Anthropology at the University of Waterloo. He is passionate about human-centered design thinking and an advocate for interdisciplinarity.

"I believe that students need to be challenged more in high school," says Ian, "Not necessarily in terms of harder course material, but rather in thinking critically and making connections across subjects." He believes that students who understand the relevance and value of what they learn in school are flexible and ready for life after graduation.

A powerful intrinsic motivation for learning wasn't something that Ian found until he entered the Centre for Knowledge Integration. The flexibility of the program forced him to take ownership, to craft an education that helps to fill the needs he sees in the world.

Emerging technologies are something Ian sees as being a key factor in the education landscape of 2030. "Information is more and more accessible, but the truth remains that there are things that don't exist online," says Ian, "If we put too much emphasis on the use of technology, social barriers will start to form and effective human-to-human collaboration could be lost."

Noor Siddiqui
/ *2012 Thiel Fellow, Co-founder, Remedy*
/ *Founder, If Not Now*

In 2012, Noor Siddiqui was awarded a Thiel Fellowship of $100 000 to work with the bottom billion cohort of the global population who survive on less than a dollar a day. "There is no greater threat to the progress of humanity than the persistence of poverty," says Noor. "I see the bottom billion as this incredible, untapped resource."

She sees monetizing education as just one of the ways to empower this marginalized population. Her project focuses on creating an alternative educational curriculum that allows students to earn money and put food on the table while they learn. By connecting individuals to training and employment and industries with increasingly capable human capital she is driving towards a globally beneficial solution to poverty.

Noor put college on hold in order to accept the Thiel Fellowship. "Whether you're 17 or 27, to be an entrepreneur you will need to learn a whole new skill set that college couldn't teach you. I don't see the fellowship as undermining college or formal education at all; rather I see it as providing an accelerated avenue for learning."

Kendall White
/ *Canadian Aboriginal Youth Advocate*

Kendall White is a community activist with a passion for Aboriginal and environmental issues. She grew up in Ontario's Temagami First Nation where the community's one room school house served four grades. At age 13, she left home for the nearby city of North Bay to pursue further schooling despite the challenges of living away from home and far from family.

"I struggled to believe in myself for a few years while I adjusted to all these changes and the instability," Kendall says of those early years. "As a Canadian Aboriginal teenage girl, I am glad that I have been able to progress to where I am now, despite many negative circumstances in my life." She is currently studying to become an environmental technician at Sir Sanford Fleming College and serves as Youth Director of the Temagami Community Foundation – a role dedicated to ensuring that youth are engaged, involved and have ownership in community decisions.

In 2010 Kendall travelled to Geneva to speak on behalf of the Aboriginal Youth of Canada as part of a delegation encouraging the UN Canadian Government to end the inequities in First Nations education, health, child welfare, and culture and language programs. "Inequality in education is a crucial issue. Some say we are what we know, so what are we if we're denied the right to knowledge?" says Kendall.

Victoria Yang
/ *Member, Ontario Minister of Education's Student Advisory Council*

Victoria Yang is a student at Waterloo Collegiate Institute where she received the prestigious Award of Honour, which recognizes excellence in academics, athletics, and activities. While many of her classmates have moved on to post-secondary education, Victoria has chosen a

fifth year of high school. "I'll be using the time to take part in WCI's cooperative education program and to really evaluate where I want to be in September of 2014," says Victoria.

She has been appointed to Cohort 5 of the Ontario Minister of Education's Student Advisory Council, a diverse group of sixty students from all parts of the education system and regions of the province, and representing various interests. As a part of the Minister's Student Advisory Council, Victoria is promoting Student Voice initiatives to ensure that students are able to share their perspectives and to exact meaningful change within schools and Ontario's education system.

"As a student representative," says Victoria, "I've observed and experienced many challenges in education first-hand, from youth apathy to the disconnect between students and education providers." Her vision for high schools in 2030 is for a learning environment where youth develop a passion and caring for global issues and are motivated to seek effective solutions.

Hirad Zafari
/ *Chair of the Board of Directors,*
Ontario Student Trustees Association

Hirad Zafari is Past-President of the Ontario Student Trustees Association and now serves on its board of directors. He is a former Student Trustee for the Toronto District School Board (TDSB), where he represented and advocated for the needs and voice of over 250,000 students, as well as a former member of the Minister's Student Advisory Council.

He is a founding member of Stick It To Fast Food, a social media boycott and awareness campaign created to encourage students to make their own lunches instead of buying and eating fast food every day.

Hirad's vision for high school in 2030 is one where the decision making process is a partnership between students, teachers, and parents. He believes that when students are given the opportunity to give feedback on the decisions being made for them, they will be much more engaged and successful, both inside and out of the classroom.

Facilitators

Michael Brooks
/ *Science Writer*

Michael Brooks is an author, journalist, and broadcaster with a PhD in quantum physics. He is a consultant at New Scientist and writes a weekly column for *New Statesman*. He is the author of the bestselling *13 Things That Don't Make Sense and Free Radicals: The Secret Anarchy of Science*. Combining his passion for education with journalistic scrutiny, he is leading the team charged with assessing promising learning pathways for the decades ahead and reporting recommendations in the Equinox Blueprint.

Bob Holmes
/ *Journalist*

Bob Holmes is a journalist and educator. Since 1994 he has been a consultant for *New Scientist* magazine, and he has also written for other publications, including *Science*, *Health*, *US News&World Report*, and *National Wildlife*. He has taught science journalism at the University of California at Santa Cruz, the University of Alberta, and Bamfield Marine Sciences Centre on Vancouver Island, Canada. He also has a PhD in Ecology and Evolutionary Biology tucked away in a box somewhere. Bob lives in Edmonton, Alberta, where he enjoys foraging for wild mushrooms when it's too warm to ski.

Dan Normandeau
/ *Partner, Conversart*

Daniel Normandeau is a management consultant with over 30 years' experience in the private and public sectors, who focuses on change management, strategic planning, organizational development, and organizational and individual learning. He holds a Master's of Public Administration from Carleton University, a Diploma in Education from McGill University and a Bachelor of Science from Concordia University's Loyola College. His strengths include an ability to assist large as well as smaller groups, executive teams and their organizations to work effectively together to envision, plan, implement, and sustain change. Dan's objective for every group conversation in any field of endeavour is to create the right conditions for people to come together and create ideas that generate high impact results.

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and the Equinox Summit

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