

A Rich Seam

How New Pedagogies Find Deep Learning

Authors

Michael Fullan

Maria Langworthy

Foreword by

Sir Michael Barber

January 2014

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Michael Fullan & Maria Langworthy

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Finally, we would like to extend our most sincere thanks to the teachers, students, schools, education system leaders and education experts (listed on the following page) who shared their time, ideas, experiences and stories with us. You have made this a truly deep learning experience.

Practitioners of New Pedagogies and Deep Learning Interviewed:

Students

Catherine Vlasov, Toronto, Canada
Students from Bellevue International School in Washington, United States
Students from WG Davis, Park Manor and Central Peel Secondary Schools in Ontario, Canada

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Kelli Etheredge, Alabama, United States
Dianne Fitzpatrick, Ontario, Canada
Josh Fullan, Ontario, Canada
Mette Hauch, Copenhagen, Denmark
Rhonda Hergott, Ontario, Canada
Kristin Leong, Washington, United States
Neil Lyons, Ontario, Canada
Kate Murray, Clontuskert, Republic of Ireland
Pauline Roberts, Michigan, United States

School, District and Regional Education Leaders

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James Bond, Principal, Park Manor, Ontario, Canada
Jan Courtin, Superintendent of Education, Peel School District, Ontario, Canada
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Foreword

by Sir Michael Barber

The digital revolution is transforming our work, our organisations and our daily lives. Driverless cars are now legal in three American states. One third of payments in Kenya are made via mobile phones. Wearable computing will soon mean that your jacket will monitor your heart rate (should you want it to). I have seen a violin - played beautifully - that was 3-D printed.

This revolution is already in homes across the developed world and increasingly in the developing world too. And there, it is transforming the way children and young people play, access information, communicate with each other and learn. But, so far, this revolution has not transformed most schools or most teaching and learning in classrooms.

Where technology is used, research findings on its impact on learner outcomes are disappointing. The technological revolution however, does not allow us to abandon our ambition to use technology in classrooms. Nor can we go back to teaching the way we have been so far: the teacher at the front transmitting knowledge and the children listening quietly. The research on brain activity by Rosalind Picard and her colleagues at MIT's Media Lab suggests that students' brain activity is nearly non-existent during lectures - even lower than when they are asleep. Lectures equal brain "flatlining" and, as Professor Eric Mazur of Harvard University's Physics Department puts it, students *"are more asleep during lectures than when they are in bed!"*

For these reasons, we need a new pedagogy.

There is another reason too. In the 20th century we expected school systems to sort people: those who would go to university and those who wouldn't, those who would do professional jobs and those who wouldn't, and those who would fill the semi-skilled and unskilled jobs for which minimal learning at school was required.

In the 21st century we are aware that this is not good enough - not good enough morally, not good enough socially and not good enough economically. Machines can do much of this work better than people. We should be able to celebrate that fact, but we can't, because the transformation is leaving millions of people without work, especially young people around the world. Only the well educated can possibly thrive in the world that is coming. We need every young person to graduate from school ready for college, career and citizenship. Everyone.

Meanwhile the growing capacity and growing tendency for school systems to learn from each other at every level - from classroom to ministry - are indications of the huge potential benefits of globalisation. One implication is that we will see the new pedagogy emerge in widely distributed places across the globe. Another is that teachers and system leaders, wherever they are, will be able to learn very quickly from their peers across the world.

If we could develop a new pedagogy that would help us rise to these two challenges and make the most of globalisation to spread it across the world, we would see a huge acceleration in the improvement of education outcomes - in place of the frustratingly slow incremental gains of recent decades. Moreover, we would see learning outcomes that would include not only literacy and numeracy, vital though they are, but also those wider, less well-defined outcomes such as problem-solving, collaboration, creativity, thinking in different ways, and building effective relationships and teams.

At Pearson we have commissioned a series of papers by leading education thinkers that we hope will help educators around the world understand and contribute to resolving the huge education challenges of our era.

This paper, by Michael Fullan and Maria Langworthy, is the first in the series, and it addresses the issue of the new pedagogy, which is central to the future agenda. The authors show that the new pedagogy is based on a learning partnership between and among students and teachers that taps into the intrinsic motivation of students and teachers alike. These new developments are so attractive that they spread easily and can be furthered by leadership that responds to and enables further learning. Crucially, this new learning is heavily based in the "real world" of action and problem solving, and it is enabled and greatly accelerated by innovations in digital technology. These forces converge to produce deep learning tasks and outcomes.

Of course much of what Fullan and Langworthy describe is not new at all. It builds on a tradition going back through to Piaget, Vygotsky and other key theorists. So, can we really accept Fullan and Langworthy's claim to be describing the new pedagogies?

I believe we can for two reasons.

The first reason is that what they describe is a new pedagogy emerging, not in laboratories or universities, but at the frontline, in classrooms as far apart as Denmark, Canada, England, Australia, Colombia, and California. It is developing, they argue, in response to the crisis of boredom and frustration among students and career disillusionment among teachers. Their case is that systems can harness this new pedagogy and make it ubiquitous, but cannot control it.

The second reason is that technology in these settings is used in such a way that it finally begins to realise its promise to transform teaching and learning. This paper builds on Fullan's important book *Stratosphere*, which argued that only when system change knowledge, pedagogy, and technology are thought about in an integrated way can technology make a dramatic difference to outcomes. It also builds on *Alive in the Swamp*, by Fullan and my colleague Katelyn Donnelly, which takes the *Stratosphere* triangle and shows very practically how educators at both school and system levels can successfully integrate change knowledge, pedagogy, and technology to improve outcomes. In short, we are at last becoming able to deploy technology in ways that will transform learner outcomes.

As Fullan and Langworthy argue, if the case they make is accepted, the implications are significant for curriculum, assessment, teaching and learning, and for future strategy and organisation at school and system levels. They argue plausibly, for example, that systems could achieve twice the learning at the same cost - a prize well worth seizing in an era when pubic finances are under pressure around the globe.

They don't claim to have all the answers or to have solved all the problems, but I believe they have advanced the argument by beginning to define the new pedagogies better, by illustrating what they look like at school and classroom levels, and by exploring these implications.

I believe that *A Rich Seam* and the other essays to come in this series will advance an important conversation - one about what we have to do and how fast we can do it, to ensure that every student on the planet gets an education that will enable them to thrive in the 21st century.

We hope that by reading this and the subsequent papers, you too will engage in that conversation by debating, commenting, critiquing, and providing practical suggestions for improving learner outcomes. This way, we can all, collectively, learn more deeply and more rapidly what we need to do to transform education around the world.

Executive Summary

This report is about three new forces that are converging to break open prodigious learning possibilities. The first force, 'new pedagogies', springs from the new learning partnerships that emerge between and among students and teachers when digital tools and resources become pervasive. The second, 'new change leadership', merges top-down, bottom-up and sideways energies to generate change that is faster and easier than anything seen in past efforts at reform. The third, 'new system economics', makes the powerful learning tools and resources that accelerate the first two forces more affordable for all. These forces are nascent, but we see them expanding rapidly – together acting as a form of positive contagion that becomes unstoppable given the right conditions.

These are changes we desperately need. A generation of youth is facing daunting challenges. Unemployment rates among young people are at an all-time high. Far too many students find their schooling boring and irrelevant, and don't consider it a predictable route to a good job and life. Amid such gloom, many of us are trying to find a way to expand the pockets of educational innovation that directly address these challenges so that they become broad, holistic change across whole systems. This report describes a rich seam of insight into how education systems are beginning to change and how new pedagogies that aim to achieve deep learning on a large scale are already being implemented in classrooms, in schools and across a few education systems.

The 'new pedagogies' are not just instructional strategies. They are powerful models of teaching and learning, enabled and accelerated by increasingly pervasive digital tools and resources, taking hold within learning environments that measure and support deep learning at all levels of the education system. 'Deep learning', in the way we will describe it, develops the learning, creating and 'doing' dispositions that young people need to thrive now and in their futures. Premised on the unique powers of human inquiry, creativity, and purpose, new pedagogies are unleashing students and teachers' energy and excitement in new learning partnerships that find, activate and cultivate the deep learning potential in all of us. Deep learning is more natural to the human condition because it more clearly connects with our core motivations: to directly and deeply engage in learning; and to do things that truly make a difference to our lives and to the world. In the best examples, teachers and students are teaming up to make learning irresistibly engaging, and steeped in real-life problem-solving.

> **"The new pedagogies require students to create new knowledge and connect it to the world by using the power of digital tools"**

What is new is that these trends are appearing more often in ordinary schools. These days you don't need to be a lighthouse school with extra resources to be innovative – you just need to allow and intelligently foster what is already emerging. Increasingly, digital access is freeing teaching and learning from the constraints of prescribed curricular content. These forces drive changes in the roles and relationships of students and teachers, among teachers, and within organisational systems. As we show through examples, when these elements are implemented effectively, they can dramatically improve learning outcomes. And we will also show that, fortuitously, the cost of providing digital access has now come within reach of education systems' fiscal capabilities. The once far-fetched notion of 'twice the learning for half the price' is becoming more possible by the minute.

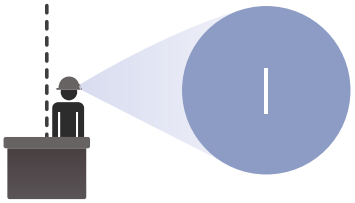
Yet achieving real gains in deep learning is not easy. Professional teaching capacity must be built for the new pedagogies to be effective. At the heart of these developments is the need for teachers and students to become excellent life-long learners, individually and collectively. In the report we define the characteristics of effective and ineffective versions of new pedagogies, and we describe the student's new role as an equal learning partner. Helping students to master the learning process; bringing greater visibility to that process; leveraging the power of peer teaching; connecting the learning to students' interests and aspirations; and continuously analysing and evaluating learning progress and choosing learning strategies based on that analysis – all of this must become part of the core repertoire of our teachers' expertise as they learn from each other, and with and from students.

We will see that when teachers and students engage in deep learning, they partner with each other in more personal and transparent learning processes where high expectations are mutually negotiated and achieved through challenging deep learning tasks. The focus becomes ensuring that students master the process of learning. Helping students learn about themselves as learners and continuously assess and reflect upon their own progress is essential to this process. The new pedagogies, as we will describe them, require students not only to create new knowledge, but also to connect it to the world, using the power of digital tools to do things that matter beyond school. It is through this final step of 'doing' things with knowledge that students gain the experience, self-confidence, perseverance and proactive disposition they need to create value in our knowledge-based, technology-driven societies.

Through the combination of the 'push' of traditional schooling that fails to keep students or teachers engaged, and the 'pull' of new pedagogies unleashed through digital access, the transformation of education systems on a broad scale becomes not only possible, but inevitable. Excitingly, these developments are now being driven and sustained primarily by teachers and students. They are buttressed by school and district leaders who cultivate the latent energy. The diffusion of this excitement is inexorable, because it reconnects teaching and learning with the realities of our day. Leaders who become partners in the deep learning processes, and who foster collaborative, risk-sharing cultures, invite and expand inherent change in schools and systems where the new pedagogies are taking off. But whole-system change still faces significant barriers in most places. These barriers reside primarily in the student assessment, teacher evaluation and school accountability regimes that currently define success for our education systems. Until we find new ways to define and measure success – ways that measure schools' adoption of new pedagogies and students' achievement of deep learning outcomes – crucial system factors will stand in opposition to innovation. New measures are urgently needed to give students, teachers, parents and leaders a clear picture of what deep learning really means in practice and how it can concretely and positively affect the futures of our young people.

There is a struggle ahead, but one where the odds for success are dramatically increasing. We do not claim to have all the answers. But because the insights described in this report are based primarily on discussions with, and observations of, students, teachers and school leaders, and because it reflects deep learning that appeals naturally to youth and adults alike, we are optimistic that what we describe is happening in practice, not just in theory. Our goal with this report is to draw attention to what is beginning to happen in the hope that it will foster sustainable change across whole systems to achieve deep learning aims.

Most of all, our message is that students and teachers can, indeed are already doing so, create the future today through their actions. We have set out what these ideas look like and have provided strategic actions that can be taken by students, parents, educators and policy makers – individually and together. We believe that new pedagogies and deep learning can be realised much sooner than we might imagine – and on a very large scale. The prospects are real, and it is time to dig in.



1 Fundamental Change in Education

Everything else has accelerated but schools have not; so schools have become more disconnected. The walls between schools and the outside need to be more permeable.

Interview with Larry Rosenstock, CEO of High Tech High Network, San Diego, California

Introduction

The 'present past' is the dominant model of education still evident in most places today. It is a model that is receding more and more rapidly as the three forces – new pedagogies, new change leadership, and new system economics – described in this report converge in an educational context that is overdue for transformation. *A Rich Seam* is about a radical change in the relationships between all the key players in learning: students, teachers, technologies, school cultures, curricula and assessments. The report is also about how and why change is occurring more organically than ever before. When conditions are so delicately balanced, the discovery of rich seams can quickly uncover massive latent resources.

Our societies are spending more time, money and resources than ever before on education.[1] More than at any time in history, an individual's educational attainment is vital to her or his future success in life. Yet our mainstream education institutions are increasingly portrayed as obsolete, designed for the purposes of an earlier, mass-production, industrial era.[2] Study after study and TEDtalk after TEDtalk[3] highlights how the high-pressure focus on surface content knowledge measured through traditional exams pushes students and teachers out of school.[4]

At the same time, the world beyond school, with its lures of digital entertainment and dire threats of future unemployment, pulls young people away from any learning perceived as irrelevant. In a recent nationally-representative Gallup survey in the United States (US), 59% of adults aged 18 to 35 said they developed most of the skills they use in their current job *outside of school*.[5] In another Gallup survey of youth, 43% of all fifth through 12th graders said they hoped to launch their own business someday, yet only 7% claimed to have any experience that would help them prepare for this.[6] Is it any wonder that studies from many countries show that less than 40% of upper secondary students are intellectually engaged at school?[7] Yet while

[1] OECD 2012
[2] Mehta 2013a
[3] See some of these at www.youtube.com/watch?v=tS2IPfWZQM4 and www.youtube.com/watch?v=zDZFcDGpL4U
[4] This frustration is captured by the rapper Suli Breaks in his YouTube video "I will not let an exam result decide my fate" www.youtube.com/watch?v=D-eVF_G_p-Y
[5] Gallup 2013a
[6] Gallup 2013b
[7] Jenkins 2013; Willms et al 2009

formal institutions of education risk irrelevance in the eyes of students, the opportunities for learning experiences connected to one's own interests and aspirations are exploding online. As Will Richardson said to us, *"The real transformation of technology and the Web is that it creates a freedom to learn and a freedom to contribute and participate on a global scale that didn't exist even a decade ago."* This is the context in which new pedagogies are beginning to spread. Under such conditions, large-scale change becomes both easier and inevitable.

Our goal in this report is to contribute to a clearer vision of a new model of education, and to provide insights into how that vision can rapidly become a reality across whole systems. This 'new pedagogies' education model is geared towards fundamentally different aims for learning; aims more relevant to this era. We and others have begun to call these new goals 'deep learning.'[8] The goals of deep learning are that students will gain the competencies and dispositions that will prepare them to be creative, connected, and collaborative life-long problem solvers and to be healthy, holistic human beings who not only contribute to but also create the common good in today's knowledge-based, creative, interdependent world.[9] These are not slogans to us. As this report reveals, we are finding more and more concrete, practical examples of the achievement of these goals within mainstream schools and classrooms. The questions we address in this report are not primarily about whether such deep learning goals should become the focus of education models. Rather, we focus on the questions of what the essential elements of these new pedagogies are, how new pedagogies can effectively develop deep learning, and why and how they are suddenly starting to spread after a generation of frustrated reform efforts.

What is New about the New Pedagogies

The 'new pedagogies' can be defined succinctly as *a new model of learning partnerships between and among students and teachers, aiming towards deep learning goals and enabled by pervasive digital access*. Most instructional elements of the new pedagogies are not 'new' teaching strategies, although we would say that the active learning partnerships with students are new. Many of the teaching strategies that have been advocated for at least a century by the likes of Dewey, Piaget, Montessori and Vygotsky are beginning to emerge and be embraced. Previously, the conditions for these ideas to take hold and flourish did not exist. Today, there are signs that this is changing. Crucially, the new ideas, compared to the past, have potentially greater precision, specificity, clarity, and above all greater learning power. We are seeing a form of positive contagion as these powerful teaching strategies begin to take hold in regular schools and in fairly traditional public education systems. They are emerging almost as a natural consequence of student and teacher alienation on the one hand, and growing digital access on the other hand. As we shall see, these developments have profound implications for curriculum, learning design and assessment.

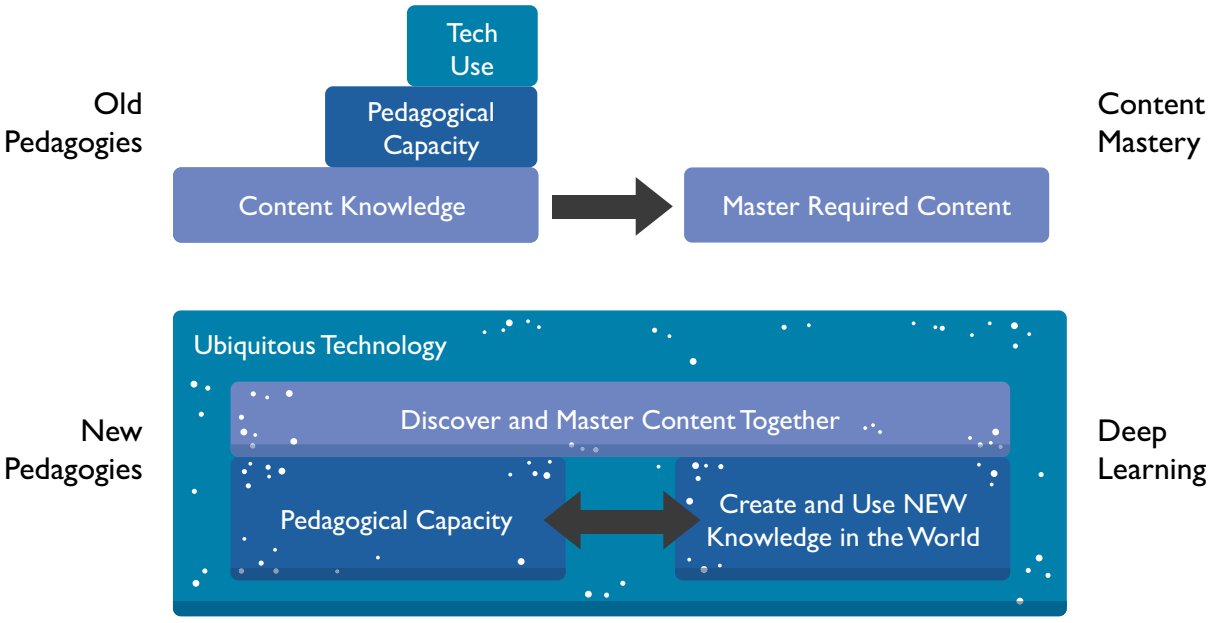
[8] National Research Council 2012; Hewlett Foundation 2012; ATC21s.org
[9] Fullan and Langworthy 2013; Barber, Rizvi and Donnelly 2012

In the old pedagogies, a teacher's quality was assessed primarily in terms of their ability to deliver content in their area of specialisation. Pedagogical capacity was secondarily important; its development in colleges of education varied a lot by country and culture. In most places, "teaching strategies" overwhelmingly meant direct instruction. In recent decades, technology has been layered on top of content delivery and used primarily to support students' mastery of required curricular content.

"The foundation of teacher quality is pedagogical capacity – teachers' repertoire of teaching strategies and ability to form partnerships with students"

By contrast, in the new pedagogies model, the foundation of teacher quality is a teacher's pedagogical capacity – their repertoire of teaching strategies and their ability to form partnerships with students in mastering the process of learning. Technology in the new model is pervasive and it is used to discover and master content knowledge *and* to enable the deep learning goals of creating and using new knowledge in the world.

Figure 1: How the New Pedagogies are Different



The above diagram helps summarise this discussion of how the new pedagogies and deep learning differ from the model of education that dominated much of the last century. First, this model is new because it aims to achieve deep learning goals that *involve the creation and use of new knowledge in the real world*. Second, this model becomes manifest in the new learning partnerships that emerge between and among students and teachers when the *learning process* becomes the focal point for the mutual discovery, creation and use of knowledge. Third, this model responds to and is *enabled by digital access inside and outside of schools*.

The dawning digital era changes fundamental aspects of education. It changes the traditional roles of teachers and textbooks as the primary sources of content knowledge. It changes *what it is possible for students to do*, as technology enables them to discover, create and use knowledge in the real world faster, more cheaply and with authentic audiences. In the past, what most educators meant by the term "applying knowledge" was working on tasks or solving problems to demonstrate mastery of concepts. But the solutions remained within the boundaries of textbooks, classrooms, and schools. Digital access makes it possible for students to apply their solutions to real-world problems with authentic audiences well beyond the boundaries of their schools. This is the real potential of technology to affect learning – not to facilitate the delivery and consumption of knowledge, but to enable students to use their knowledge in the world. Fourth, what makes these developments radical is that they are beginning to occur across entire systems.

"These factors are combining to establish groundbreaking conditions for deep learning to take off on a massive scale"

The digital era is changing the dominant paradigms for how organisations function. For much of the previous century, the dominant model was one of hierarchy, top-down management and mass standardisation for industrial manufacturing. This model influenced the organisation of schools that became more like little factories producing standardised human 'products.'[10] Today, our economies are shifting, and the new models are ones of learning and innovation, of entrepreneurship, of creativity and of global collaboration. These factors are combining to establish groundbreaking conditions for deep learning to take off on a massive scale.

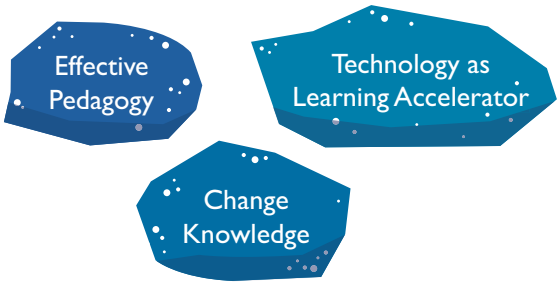
The Past and Future of this Work

The new pedagogies described in this report are part of a larger body of work that we are undertaking with a group of international colleagues and partners, collaborating to 1) provide greater clarity to what 'deep learning' means in practice; and 2) develop practical theory and evidence on how to implement this type of learning most effectively, and 3) to do this on a large scale with regular public schools. In short, we are identifying new pedagogies in action, as well as helping to spawn and learn from new examples that are rapidly emerging. The present report also builds from a stream of related writings by Michael Fullan and colleagues which began with an analysis of the most effective drivers of whole-system reform (which are effective pedagogy and collective capacity-building system-wide);[11] continued with an exposition on the potential for dramatic improvements in educational performance based on innovations in learning models;[12] and most recently provided a new model for assessing the impact of educational technologies.[13]

[10] Mehta 2013a
[11] Fullan 2010; Fullan 2011
[12] Fullan 2013b
[13] Fullan and Donnelly 2013

In Michael's book *Stratosphere* he made the case that there are three big ideas that have needed each other but which grew up independently over the past 40 years: *technology*, especially as it becomes used not only by teachers but by students as part of their learning; *pedagogy*, especially since advances in the 1990s in the science of how people learn[14]; and *change knowledge*, especially since the implementation of change became a focus around 1970 and evolved into ideas for whole system change.

Figure 2: Three Forces Leading to the Stratosphere



The argument was that it was time for these three forces to connect and fulfill the promise of revolutionising learning. *Stratosphere* argued that if pedagogy were to be the foundation, and if technology could be thought of as an enabler and tool in the service of deep learning, then we could achieve something new and powerful. It would be possible to expand this achievement across whole systems if we were to use 'change knowledge' on how to build capacities among many people working together. The ultimate goal would be to alter whole education systems by getting the vast majority of members to use pedagogy and technology in new and integrated ways to achieve a new vision of deep learning. And all of this would need to be done in a way that would meet the concerns of policy-makers and the public regarding legitimacy and result in more relevant learning outcomes. *Stratosphere* articulated the potential for dramatic improvements in educational performance, but it did not show *how* to bring about such improvements.

At the same time, there was a veritable explosion of innovations haphazardly coming onto the educational scene.[15] No compass existed to provide a guide on what kind of impact these technologies would have. So Michael worked with Katelyn Donnelly to develop a simple index that would help people assess the potential of digital innovations according to the three dimensions of 1) pedagogy, 2) implementation/system change, and 3) technology. We called this report *Alive in the Swamp*, because the current mix of digital innovations for education was and remains a swamp: murky and mysterious, but definitely alive and rapidly growing. The index offered indicators for each of the three dimensions, and was used to assess a set of digital innovations. It was immediately apparent that the pedagogy and implementation/system dimensions were consistently weak across most innovations. Technology entrepreneurs find it more exciting to develop digital innovations than to grapple with pedagogical considerations and support systemic implementation. Michael and Katelyn are now developing further tools so that people and educators can analyse innovations against these three key dimensions.

[14] Bransford *et al* 2000.org
[15] Fullan and Donnelly 2013

Finally, through the *New Pedagogies for Deep Learning* global partnership, we wrote the white paper, *Towards a New End: New Pedagogies for Deep Learning*[16] to initiate a partnership with education systems in ten countries to mobilise deep learning goals in primary and secondary schools. That project focuses on the implementation of deep learning goals enabled by the new pedagogies and accelerated by technology.

A Clearer Vision

This brings us to the present paper. A great deal of change is happening already in classrooms, schools and systems. Some of it is quite exciting, but we really don't know much, with any degree of clarity, about how it works as a whole. What exactly do these pedagogies look like in terms of teachers and students' roles? How do we know that these new roles and practices work to achieve new learning outcomes? Why and how do they expand across whole education systems? And finally, what does it all cost? In this report, we focus on exploring answers to these questions, mining for insights that can lead to more effective implementation and rapid expansion. Many educationalists throughout the world are prospecting, looking for how deep learning can be found in our schools. Our goal is to bring greater precision and clarity to these quests by examining new pedagogies as they are already being practiced. We are at the early stages of disruptive innovations, which represent a new period of development, trial, error and further development. Pioneers are trying new things, exploring different veins that appear to have value – seeking gold that is often unexpectedly elusive.

The present report begins to define the new pedagogies more clearly by sharing examples of core components being implemented by teachers, schools and whole education systems. We examined reports, books and videos from the ever-growing body of literature on these new developments. But the detailed concepts we present here emerged through our interviews and observations with students, teachers, school leaders, education system leaders and policymakers from 12 countries. These individuals provided stories, examples, videos and learning artifacts such as lesson plans and assessment strategies. We also collected and made videos that vividly illustrate the concepts and ideas of the new pedagogies model (links to these are provided throughout the paper). In this report, we integrate all this evidence into what the research and theory are telling us, and examine the more effective and less effective versions of these new pedagogies, relative to desired learning outcomes. By more clearly articulating the core elements of new pedagogies – describing how they can be successfully integrated and implemented to achieve deep learning goals – the reports seeks to provide a rich seam of insight for how new pedagogies find deep learning.

[16] Fullan and Langworthy 2013. See www.newpedagogies.org

It is the *integration of core components* of these pedagogies and their effective implementation across whole systems that leads to deep learning for all students. To summarise, there are three big 'new phenomena' on the scene:

i. ***New Pedagogies*** that represent new learning partnerships between and among students and teachers. These include deep learning tasks and the use of pervasive digital resources.

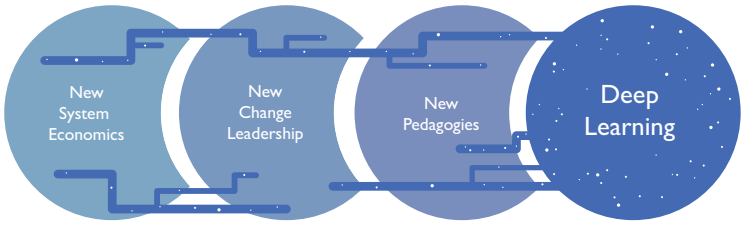
ii. ***New Change Leadership*** based in a new theory of inherent change that is more organic and spreads rapidly under the right conditions.

iii. ***New System Economics*** that deliver the new outcomes in a high-yield manner relative to cost.

Figure 3 depicts these three forces, which we describe briefly below.

New Pedagogies

Figure 3: Three Forces for Deep Learning



The new pedagogies are not as simple as 'flipped' classrooms or MOOCs (Massive Open Online Courses) where content information and existing knowledge are 'delivered' online rather than through textbooks or live in classrooms. As Will Richardson[17] bluntly puts it, "simply adding a layer of expensive tools on top of the traditional curriculum does nothing to address the learning needs of modern learners." The new pedagogies are much more than the 'flipped model' and other ad hoc innovations. They are substantially more complex:

- The explicit aim is deep learning that goes beyond the mastery of existing content knowledge. Here, deep learning is defined as 'creating and using new knowledge in the world.' Technology has unleashed learning, and the potential for students to apply knowledge in the world outside of school; new pedagogies leverage all of this in the formal learning process.

- Teaching shifts from focusing on covering all required content to focusing on the learning process, developing students' ability to lead their own learning and to do things with their learning. Teachers are partners with students in deep learning tasks characterised by exploration, connectedness and broader, real-world purposes.

- Learning outcomes are measured in terms of students' 1) capacities to build new knowledge and to lead their own learning effectively, 2) proactive dispositions and their abilities to persevere through challenges, and 3) the development of citizens who are life-long learners.

[17] Richardson 2013

These pedagogies have the potential to engage *all* students, not just those who are already highly motivated to learn within and outside the classroom. The teacher's role in this demands sophisticated pedagogical capacities, requiring expertise across a repertoire of different teaching strategies and continuous evaluation of where students are in their learning progressions. Everyone becomes a teacher in the new pedagogies, and everyone becomes a learner. Much more is expected and demanded of students; to build their confidence through personal feedback and encouragement, with the overall aim to unleash, indeed create, their awareness of their own potential. Ultimately, these pedagogies foster a new kind of learning that is more engaging and more connected to real life and that better prepares young people for life and work in today's world.

New Change Leadership

The new change leadership, the focus of the sixth section of the report, discusses a new 'inherent change' model: a model that taps into the human need to do things that are intrinsically meaningful, and to achieve outcomes that are of value to others. Put simply, the new pedagogies spread when the teachers, students and leaders who are implementing them collaborate to share their experiences and energy, and to analyse the often amassing impact these learning practices have on everyone involved. The new change leadership helps to stimulate, responds to and guides a dynamic process that consists of 1) directional vision, 2) letting go as people try new things, and 3) reining in what is learned. This process generates and tests new ideas in a never-ending cycle.

Where the new pedagogies are taking off, leaders have quickly recognised the need to share the leadership of learning so that changes can spread rapidly. These leaders focus on paving the way, and on creating conditions that pull students' and teachers' initiative and potential forward. They become storytellers, nourishing determination as students strive to build their learning capacities and teachers push to build their pedagogical capacities. They also acknowledge mistakes and drive transparent, collaborative reflection to ensure they learn from the things that didn't work. They encourage risk. They measure progress in new ways. *They stop doing things that do not support the new direction.* They cultivate social capital and leadership, not only among other leaders, but also among students, teachers, parents and the broader community of stakeholders, making everyone a participant in the new learning. They use ubiquitous access to technology to enable and accelerate all these things, and they keep learning at the forefront of all digital strategies. Alongside their students and teachers, they continuously assess what is working. These developments are so impressive because they seem, in many cases, to be taking place spontaneously. But in fact, as we will see, leaders in such cases are cultivating their cultures and building capacities in some very specific ways.

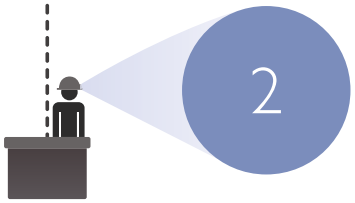
One of the biggest systemic challenges to the spread of the new pedagogies is that they are not yet being measured in any coherent way. Unfortunately, most systems that we have seen simply do not yet have ways to measure the new pedagogies and deep learning outcomes. Assessment is of paramount importance to policymakers, leaders, teachers and parents, not just because public accountability demands it, but because all parties need to know what works in order to achieve the new aims. What is crystal clear from our interviews and from existing research is that many current curriculum standards, alongside standardised assessments that primarily measure content reproduction, are the greatest barriers to the widespread adoption of new pedagogies. Greater clarity and precision of deep learning concepts, followed by valid new ways to measure deep learning outcomes, are essential for the expansion of the new pedagogies across whole systems. This report provides a starting place.

"Many current curriculum standards, alongside standardised assessments that primarily measure content reproduction, are the greatest barriers to the widespread adoption of new pedagogies"

New System Economics

The new pedagogies can also deliver economically. No new system can take hold if it does not deal with the current perception of education as increasingly expensive without commensurate results. In Chapter 7 we present the economics of the new pedagogies, demonstrating how they can potentially deliver twice the learning for the same levels of investment. This is not about saving money, but recognising that it really is less expensive when people are naturally learning – for one thing you save money by not having invest in persuading people to do something they don't want to do. More importantly, the yield relative to investment will dramatically increase as people voluntarily spend more time on purposeful learning. We share a body of evidence that suggests how the new pedagogies model, when implemented effectively, can lead to dramatic breakthroughs in learning outcomes. We outline the economic and policy realignments needed to achieve this. Ultimately, the new pedagogies deliver because they provide greater overall value for societies' investment in education. They develop the learning capacities, creative experiences, and, 'know-how' our young people need to gain a solid foothold in the onward trek through life and work in today's world.

In subsequent chapters we will provide greater clarity and precision to this new model for learning. Such a vision can convert the energy latent in ordinary schools, and optimise change leadership efforts at all levels of education systems. In short, change is already happening, but what is happening has not been fully recognised or articulated. It is in this sense that our report can serve as a rich seam of insight into how to dramatically expand new pedagogies that find the deep learning nascent in us all.



2 The New Pedagogies – Learning Partnerships

Technology is just a tool. It's a powerful tool, but it's just a tool. Deep human connection is very different. It's not a tool. It's not a means to an end. It is the end – the purpose and the result of a meaningful life.

Melinda Gates, Philanthropist, Duke University Commencement Address, 2013

At the heart of most teachers' motivation is the desire to ignite learning in others, to kindle curiosity and creativity and to light up the potential of the human mind (although many teachers have had this desire blunted by their experiences of working in oppressive conditions). In our interview with Tan Chen Kee, a principal in Singapore, she put it like this: "the heart of a good teacher is the student – what the student needs to learn. When teachers see that a new way of teaching or new tools spark engagement and learning, they naturally gravitate towards these new pedagogies." We heard this sentiment expressed repeatedly in our interviews. The core components of the new pedagogies described below were drawn from these teachers' stories and examples. Aspects of these components are familiar from the education theory and research of the past 100 years: knowledge construction, real-world problem-solving, feedback, the importance of meta-cognitive strategies.[18]

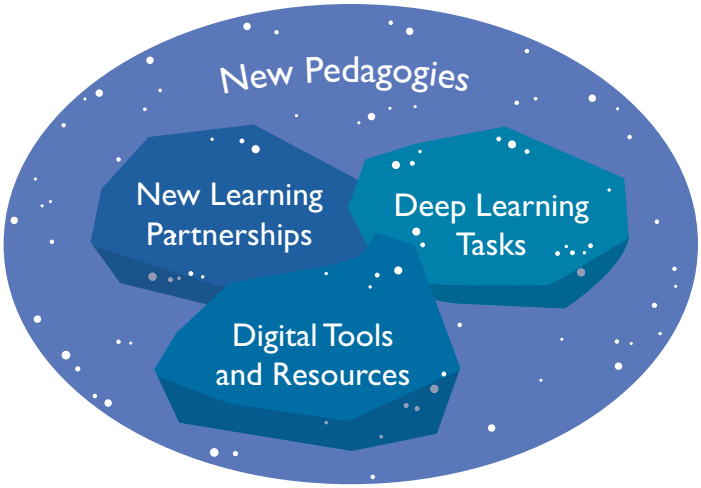
As we delved into the new pedagogies and how they work in practice, we unearthed three core components that, when integrated, enable deep learning outcomes:

1. **New learning partnerships** between and among students and teachers.
2. **Deep learning tasks** that re-structure the learning process towards knowledge creation and purposeful use.
3. **Digital tools and resources** that enable and accelerate the process of deep learning.

[18] Dumont et al 2010; Bransford et al 2000

The following Figure depicts the new pedagogical elements.

Figure 4: Core Components of the New Pedagogies



This and the following three chapters will examine these three components in the light of two central questions. First, what exactly do these components look like in action? And second, how do we know that they are having a favourable impact on learning? This chapter covers the new learning partnerships, Chapter 3 deep learning tasks, and Chapter 4 the role of digital tools and resources. Chapter 5 then examines the impact of effective new pedagogies on learning outcomes.

The New Learning Partnerships

The starting place for all of this lies in the relationship between students and teachers and how their respective roles are changing. In our interviews, teachers often began with descriptions of students' mindsets today. We frequently heard the refrain of distraction: "Students no longer listen," and "Kids nowadays have an attention span of three seconds." But what was interesting was these teachers' explanations of how they addressed students' distraction:

> *Students today want to be actively engaged, they want to determine the path of their own learning, chart their own learning journeys. Technology tools have exploded the way they interact with the world around them, and it's changed how they want to be in the classroom.*
>
> Pauline Roberts, 5th and 6th Grade Teacher, Michigan, USA

Many of the teachers we interviewed had students who were no longer willing to accept the role of being passive receivers of learning defined by someone else. Young people are now digitally connected to overwhelming amounts of information and ideas. Amid this, students greet teachers' attempts to deliver content knowledge using traditional didactic approaches with scepticism. In particular, once they have mastered basic skills, students know there is so much more 'out there' and are unimpressed by pre-packaged, depersonalised learning experiences. But at the same time, teachers cannot simply let go of the reins. Teachers risk erring by standing too far to the side, by being too ambiguous about learning goals or failing to define success. Too directive or too passive: these are the dysfunctional ends of the teaching continuum in the new pedagogies, as we shall see. Where the new pedagogies work best, *learning partnerships* between and among students and teachers emerge.

Effective partnering is built on principles of equity, transparency, reciprocal accountability and mutual benefit. When you listen to the stories of how the new pedagogies unfold with teachers and students, you find a unique thread at the heart of most of them. These stories are animated by descriptions of teacher-student relationships where teachers are becoming *partners* in the learning with students. Let us stress, *teachers as mere facilitators are poor pedagogues*. The teachers we interviewed almost unanimously recognised the importance of proactively learning alongside students, in contexts where students are contributing their own ideas, experiences and expertise to the learning process.

> *I'm just one of them. We're all there together; they have expertise that I don't have – I see it coming to the forefront with technology – but also with everything. They have knowledge that I don't have... It's not all coming from me.*
>
> Neil Lyons, 8th Grade Teacher, WG Davis School, Canada[19]

Through such partnering, teachers not only become learners themselves, but also begin to see learning through the eyes of their students. This 'visibility' is essential if teachers are to continuously challenge students to reach for the next step, and if they are to clearly see whether teaching and learning strategies are achieving their intended goals.[20]

These learning partnerships are the relational context in which the most powerful strategies of the new pedagogies find their home. The partnerships emerge from a set of roles for both teachers and students different to the ones found in many classrooms in the world today. In Table 1 on the following page, we begin to outline these roles, but since these new pedagogies are emergent, we consider our descriptions to be an initial framework for further discussion, rather than conclusive definitions.

[19] See Neil and other teachers describe the new partnership in the video from WG Davis School in Ontario, Fullan 2014b, Motion leadership film series www.michaelfullan.ca/ontario-wg-davis/

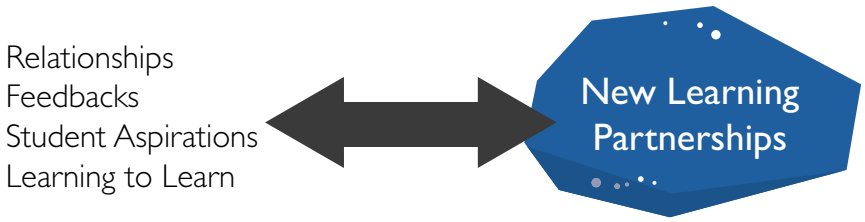
[20] Hattie 2009

Table 1: The Emergent Roles of Teachers and Students in the New Pedagogies for Deep Learning

Teachers (Pedagogical Capacity)	Students (Deep Learning)
Build trusted relationships with students and peer teachers; seek good mentors	Build trusted relationships with teachers and peers; seek good mentors
Help students find and build on their interests and aspirations through deep learning tasks	Explore own interests and aspirations in learning goals and tasks
Require challenging learning goals, tasks and success criteria for self and students that require creation and use of new knowledge	Develop capacity to define learning goals, tasks and success criteria, partnering in the learning process
Develop repertoire of teaching strategies; use different strategies to activate learning	Reciprocal teaching and learning from and with peers and teachers
Provide high-quality feedback and encouragement, especially when students face challenges in learning	Develop capacity for reflection and perseverance in the face of challenges; provide high quality feedback and encouragement to others
Collaborate with other teachers and leaders researching the impact of different learning strategies on students (i.e., use an inquiry cycle approach)	Provide feedback to teachers and peers on what is working in one's own learning; build mastery of the learning process and one's own progress
Model a proactive disposition towards learning, creating new knowledge and taking action with that new knowledge	Develop intellectual and attitudinal dispositions towards creating new knowledge and doing things with it in the world
Continuously discover and create digital learning tools and resources to: 1) explore new content, concepts, information and ideas; 2) challenge students to create new knowledge; 3) connect with students, peers, and experts beyond the classroom; 4) accelerate students' ability to drive their own learning process; and 5) assess and share information on students' learning abilities and dispositions	Continuously discover and create digital learning tools and resources to explore new content, concepts, information and ideas. Use these tools to create new knowledge, to connect with peers and experts throughout the world and to use new knowledge in the world

These roles will be described and exemplified in the rest of this report. We will start by describing four of these emergent roles in the new learning partnerships: 1) relationships, 2) student aspirations, 3) feedback, 4) learning to learn and peer tutoring.

Figure 5: New Learning Partnerships



Relationships

Decades of research on teacher-student relations bears out what teacher Pauline Roberts from Michigan put quite succinctly: "If kids know you care about them as human beings, it makes all the difference." Students (and with reason) take the stance with teachers (and other students) that if you are not willing to learn from me, I am not willing to learn from you. In the new pedagogies human relationships take a new and more central place in the learning experience. They are not confined to two minutes before or after class. In the new pedagogies, the entire learning experience is deeply embedded in these relationships, which exists between and among students and teachers, between student peers, between students and their families, and with social networks that connect those of similar learning interests and aspirations. The new pedagogies muscularly leverage all of these relationships as part of the learning enterprise, inherently making the learning more of a conversation and a mutual endeavour:

> *Children started to take responsibility. They would take videos of themselves sharing their understanding with the teachers, and asked them to share this back with the other teachers. Kids and parents became involved with the goal setting.*
>
> Valerie Karaitiana, Principal, Dallas Brooks Community Primary School, Victoria, Australia[21]

As our colleague Will Richardson[22] says of these relationships, "teachers must be co-learners with kids, expert at asking great, open-ended questions and modelling the learning process required to answer those questions. Teachers should be master learners." The roles of the teacher in these partnerships go well beyond providing students with descriptions and explanations of content or subject matter. These relationships first start with the basic capacity for building trust. One of the teachers we interviewed, who teaches at a school in Denmark with a high population of youths at risk, described her view on how trust serves as the basis for learning:

> *Trust is the way to go. If they [students] trust you [the teacher] as a person, then they engage. It's about [the teacher] being authentic. … I have to teach by being engaged and being human and involving them. They need to know that I am a person who has a life [outside of teaching], and I need to come across as a human who they can identify with; and then it becomes real to them. We trust them. We bring them in.*
>
> Mette Hauch, Teacher, Hellerup School, Denmark

[21] See the student voice video from Dallas Brooks Community Primary School: www.youtube.com/watch?v=j2HwGcOcpKM
[22] Richardson 2013

Building trust is a mutual endeavour. From the teacher side, it involves attention to the well-being of the student beyond immediate cognitive achievements. From the student side, this trust opens the door to a partnership approach to learning in which one responsibly articulates and pursues one's interests, needs and aspirations as part of the learning cycle, and engages in the learning process with a more proactive, creative stance.[23] When students are given a legitimate voice in decision-making, and learn how to use that voice effectively, they start on the path towards becoming leaders of their own learning.[24]

Student Aspirations

Sir Ken Robinson has described the critical roles of teachers in helping students find their element.[25] Cal Newport[26] argues that people don't find their passion by seeking it directly but, rather, through skill development and experiences. Through these, they discover what it is they like and become good at it (we will describe this skill development below as 'deep learning tasks'). Thus, a core role of the teacher in the new pedagogies is to help students discover and sort out the experiences that best suit them (in conditions where students don't always know what they want when they set out). In other words, as Robinson puts it, one of the key roles of the teacher is a *caring mentor* who helps students to find and move towards their own aspirations.

Connecting learning to students' real lives and aspirations is often what makes the new pedagogies so engaging for students. In many of our discussions with students, they said that learning in the 'old' way at school was all about learning the past. Instead, they wanted to learn in ways that connected to their futures.

> *Kids are bombarded with information… to engage them, we have to harness their interests, and know where they are at. Otherwise, so many things will distract them. I have to be a partner with them, to know who they are on a lot of different dimensions. To know what engages them – I have to really get to know them. It is a two-way conversation.*
>
> Pauline Roberts, 5th and 6th Grade Teacher, Michigan, USA

> *Students today - because of their broad, wide and deep connectivity to people and information anywhere - their mindsets are driven by the ability to connect at will. So their notions of the world are much flatter and much more open. It tempers the way they look to learn. For students today when the learning is not connected to their own relevance, their interests, their own needs, then engagement pretty much doesn't occur.*
>
> Max Drummy, Professional Learning Leader, Department of Education Tasmania, Australia

[23] See www.youtube.com/watch?v=XJd8PPZ2XHY&feature=youtu.be and www.youtube.com/watch?v=j2HwGcOcpKM for examples of meaningful student voice
[24] Thanks to our colleague Russ Quaglia for the language on student voice
[25] Robinson 2009, 2013
[26] Newport 2012

One great example of this kind of connected, relevant learning activity was described by Kate Murray, a teaching principal at St. Augustine's, a small rural school in Clontuskert, Ireland. As Kate told us in our interview, engaging students is about *"bringing it back to themselves – what their own context is, their own families, their own parish."* This thinking informed a school-wide learning project that focused on ringforts.[27] Ringforts are circular earthen mounds built as houses in the Bronze Age, which have long been associated with the presence of fairies. There are 204 ringforts in the school's parish and many of the students were interested in them, felt connected to them through their own ancestry, and chose them as a focal point for learning. So students aged eight to 12 studied the history of ringforts, including what people ate and wore when they lived in them; they visited them with an archaeologist; they mapped the forts using mathematical models; they built their own version of a ringfort in their school; they wrote a script and acted it out in their own film; and they travelled to heritage meetings throughout the country and gave presentations. Ringforts became a meaningful focal point for the achievement of multiple curricular learning goals. As Kate said, "they are getting it in a way that makes learning come alive for them." When teachers and students connect the learning, it makes learners feel less like cogs in machines, and more like learning is something that is natural, instinctive and embedded in their aspirations and their world.

Feedback

The new learning partnerships at the heart of the new pedagogies also generate a strong foundation for both teachers and students to provide highly effective feedback in the learning process. To do this, teachers and students must develop a common understanding of what learning progress looks like and actively engage in evaluating that progress, adjusting and refining their work as they go. Such a model is very much like working practices in knowledge-based organisations, where individuals or teams come up with initial products or programs and then refine and improve them based on testing and feedback. Indeed, the feedback cycle is where 'it all comes together.' In the new pedagogies, feedback between and among teachers and students stands at the critical nexus between learning goals, the kinds of deep learning tasks we will describe below, and deep learning outcomes. Only the teacher or peer with a solid understanding of an individual student, and where that student is in their learning progression, can provide the appropriately challenging feedback that will push that student one step further. As we will describe in Chapter 4, learning technologies are also using feedback based on student performance data to adapt the content and challenges they present to students. It is essential to use evidence and data to support the feedback message and thereby help students understand their own work more clearly in relation to learning goals.[28] Through interim feedback, students' strategies and tactics in the course of learning can be adapted to improve final work products or performances. Students can also be rich sources of feedback for their peers. This kind of peer feedback is not only for advanced or older students – we have seen it delivered effectively by seven year olds.[29]

[27] See blogs, podcasts and photos from the Ringfort project: http://clontuskert.scoilnet.ie/blog/2013/01/25/ringfort-project-celebrations/
[28] Wiliam 2010; Wiliam and Black 2005
[29] Video of this peer feedback from 7 year olds here: http://resources.curriculum.org/secretariat/snapshots/primaryliteracy.html, scroll down to "Writing Conference: Peers"

Getting the *right kind of feedback* is essential not only to promote learning progress; it contributes to the development of essential skills needed for students' ability to cope with hardships. A growing body of research is demonstrating that non-academic character skills such as *grit*, *tenacity*, *and perseverance* have a strong relationship with an individual's capacity to overcome challenges and achieve long-term success. Angela Duckworth[30] and others have begun to show that the capacity for sustained effort or 'grit' is a more accurate predictor than IQ of grades and of longer-term success in life.[31] Research is underway to better understand how these character skills can intentionally be developed, with initial evidence pointing to the levers of supportive learning conditions and getting the right kind of feedback. Carol Dweck's research has shown that the 'right kind' of feedback is that which encourages taking on hard challenges and focuses on students' efforts rather than their achievements.

> *When students succeed, teachers should praise their efforts or their strategies, not their intelligence. (Contrary to popular opinion, praising intelligence backfires by making students overly concerned with how smart they are and overly vulnerable to failure.) When students fail, teachers should also give feedback about effort or strategies — what the student did wrong and what he or she could do now. We have shown that this is a key ingredient in creating mastery-oriented students. In other words, teachers should help students value effort. Too many students think effort is only for the inept. Yet sustained effort over time is the key to outstanding achievement.*
>
> Carol Dweck, Professor of Psychology at Stanford University, Interview, 2005[32]

Learning to Learn and Peer Tutoring

The kinds of learning partnerships we have described above – linking learning to student aspirations, providing powerful feedback – build students' awareness of the process of learning. Learning to learn, where students become meta-cognitive observers of their own and others' learning processes, is a fundamental goal in the new pedagogies. The goal is not only to master content knowledge; it is to master the learning process. Learning to learn requires that students begin to define their own learning goals and success criteria; monitor their own learning; critically examine their own work; incorporate feedback from peers, teachers, parents or simply other people in general; and use all of this to deepen their awareness of how they function in the learning process. As students make progress in mastering the learning process, the teacher's role shifts gradually away from explicit structuring of learning tasks, and towards providing feedback, activating next-level learning challenges, and continuously developing the learning environment.

[30] Duckworth TED talk: www.ted.com/talks/angela_lee_duckworth_the_key_to_success_grit.html
[31] Tough 2012. Full discussion on these themes: www.paultough.com/2013/02/true-grit-can-you-teach-children-character-2/
[32] Dweck 2005

The learning partners must find the right balance between structure and independence, and that balance will be unique to each learning context (subject, task complexity, level of familiarity with the content, etc.)

Peer tutoring, where students teach their peers and their teachers is, in our view, a powerful vehicle to assist students in developing awareness and mastery of the learning process. Peer tutoring requires that students become involved in the process of defining learning goals, providing assessment criteria, and so forth. One teacher we interviewed described a great example of how peer tutoring can foster learning process mastery. Mette Hauch at Hellerup School in Denmark said, "I see students being most engaged when they have to teach other students." Her learning task asked students to select a literary work, analyse it, and then develop their own learning materials and assessments. Students then taught their peers using these materials and assessed their peers' understanding.

When they are teaching their peers, they seem to go more deeply — they take it a step further. Teenagers are a tough crowd. They have a lot more to lose. They take so much more ownership over it; and it makes them so much more proud if they can do it.

Mette Hauch, Teacher, Hellerup School, Denmark

Such projects must last long enough for students to plan and develop their work, have opportunities to improve their work based on feedback, and have clear learning goals and success criteria that make progress visible. As we will describe below, the deep learning tasks that structure the learning process in the new pedagogies do not last merely one or two class periods. They tend to be multi-week projects or longer, just like complex projects in the real world of work. Mette's students don't just teach their peers once in one class – it is a common practice across all classes at the school. Students apply what they learn about effective teaching and learning in different contexts, reflecting each time on what works and what does not, developing mastery of the learning process over time. A teacher from Spain also described the impact of these approaches at his school:

Secondary students are teaching teachers and their peers. Then students really feel a part of the school, of the learning. They are the same as teachers. Most of our students, they feel the school is their work as well.

Ovidio Barcelo Hernandez, Teacher, Colegio Bilingüe Julio Verne, Valencia, Spain

Dan Buckley, a school leader who now helps lead Saltash.net Community School in England, told us this story of the impact of peer tutoring:

Between 2000 and 2005 I ran a project involving over 100 students in which I gave the students teacher training. The students then researched and delivered the entire curriculum to each other, working as teams of four 'peer teachers' per lesson. The result was an average achievement of 1.4 grades higher per student per subject across all their national examinations. Even though these groups were only 1/3 of the school population, their success took the school into the top 20 in the UK in terms of value added. The school was Eggbuckland Community School and the project was one of the first 'one laptop per child' projects that was entirely student led.

Dan Buckley, Deputy Head, Saltash.net Community School, Cornwall, England

In a final example of the power of peer tutoring, the *Learning Communities Project* in Mexico incorporates peer tutoring in rural schools throughout the country.[33] The program developed tutoring networks where students taught each other, using the curriculum as a map with each student "teacher" developing their own area of expertise.[34] Six thousand schools across Mexico have joined this movement. Data available from the first 4,000 schools to participate shows that they have significantly increased the proportion of students scoring at 'good' and 'excellent' levels in the national ENLACE examinations.

Implications for Pedagogical Capacity

Partnering relationships, connecting student aspirations, the right kind of feedback and learning to learn are all essential in the new pedagogies because they set the context in which teachers can more deeply know their individual students and, through that, analyse student progress to understand which teaching and learning strategies best *activate an individual student's learning*. Combined, these strategies of the new pedagogies alone — before we add deep learning tasks and digital tools and resources to the picture — have profound implications for teaching practices. In some countries these practices are beginning to emerge. But in many more countries the pessimist (or perhaps the realist) would say that decades of intensive effort are required to develop these practices on any scale. This is where we diverge. We note that many naturally developing elements of life and schooling are causing new pedagogies to take off now.

We observe the energy and skills that are unleashed for students and teachers as they engage in this type of authentic learning. Our hypothesis is that the speed at which these practices are being adopted is accelerating, fuelled by students and teachers moving in this direction and as a natural consequence of increasing digital access. Under these conditions rapid change is possible.

[33] See the story of Learning Communities from Maravillas, Mexico: http://vimeo.com/70279241
[34] Rincon-Gallardo and Elmore 2012

The new pedagogies require a teacher to have a *repertoire of strategies*, which may range from project-based learning through direct instruction to an inquiry-based model. But the key is that the teacher takes a highly *proactive* role in driving the learning process forward, using whichever strategy works for a specific student or task (and analysing which strategy works best). In the new pedagogies, this means interacting with students to make the students' thinking and questions about learning more visible. Here it is valuable to consider one of John Hattie's clustered findings from his analysis of over 1,000 meta-studies worldwide into the impact of different teaching and learning strategies on student learning.[35] This work covers research studies that were conducted with a total of 240 million students. The impacts of individual teaching strategies were measured through the 'effect size' of a strategy on students' learning (Hattie notes that an effect size of less than .40 is not worth considering). He developed two categories of strategies, and called these categories '*teacher as facilitator*' compared to '*teacher as activator*.' These categories can be seen as possible teaching strategies in the new pedagogies:

"the key is that the teacher takes a highly *proactive* role in driving the learning process forward"

Table 2: Hattie's 'Visible Learning' Analysis of Effect Sizes of Categories of Teaching Strategies:

Strategy Category	Effect Size
Teacher as Activator (teacher-student relationship, reciprocal teaching, feedback, meta-cognition, teacher clarity)	.72
Teacher as Facilitator (inductive teaching, student control over learning)	.19

We can see that the teacher as activator category garners more than three times the effect of the facilitator category. In the new pedagogies, teachers do not have less of a role; they have a new active role, more engaged with students and other teachers than ever before. Thus, popular notions of the 'guide on the side' may in fact be less powerful versions of the new pedagogies. Teachers who play dynamic, interactive roles with students – pushing students to clearly define their own learning goals, helping them gain the learning muscle to effectively pursue those goals, and supporting them in monitoring how they are doing in achieving those goals – have extremely strong impacts on their students' learning. Such teachers do not 'let the students learn on their own' but instead help them master *the process of learning*. Such teachers do not 'let the students learn on their own' but instead help them master the difficult and demanding process of learning. Such teachers have highly-developed pedagogical capacities. In short, new pedagogical partnerships with definable features, are one entry point into rich seams of deep learning.

[35] Hattie 2009; Hattie 2012

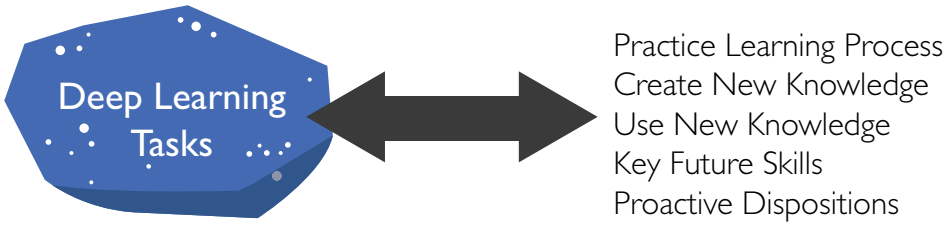
3 The New Pedagogies - Deep Learning Tasks

It's challenging, but not necessarily in the way that subjects like math and science are. Students doing this kind of work have to think and be creative in ways that they have never previously had to. I had to tackle topics and problems with an entirely new mindset that I was not otherwise used to.

Catherine Vlasov, 11th Grade Student, University of Toronto Schools[36]

The second core component of the new pedagogies is what we call 'deep learning tasks.' These tasks harness the power of the new learning partnerships to engage students in *practicing the process of deep learning through discovering and mastering existing knowledge and then creating and using new knowledge in the world.* Deep learning tasks are energised by the notion of 'learning leadership', in which students are expected to become leaders of their own learning, able to define and pursue their own learning goals using the resources, tools, and connections that digital access enables.

Figure 6: Deep Learning Tasks



[36] Catherine took part in a fantastic deep learning task called Maximum City. See it at http://vimeo.com/73389759

Deep learning tasks redesign learning activities to:

1. re-structure students' learning of curricular content (such as national curriculum goals or standards) in more challenging and engaging ways made possible by digital tools and resources.

2. give students real experiences in creating and using new knowledge[37] in the world beyond the classroom.

3. develop and assess key future skills, what Michael has called the 6 Cs:
   - **Character education** — honesty, self-regulation and responsibility, hard work, perseverance, empathy for contributing to the safety and benefit of others, self-confidence, personal health and well-being, career and life skills.
   - **Citizenship** — global knowledge, sensitivity to and respect for other cultures, active involvement in addressing issues of human and environmental sustainability.
   - **Communication** — communicate effectively orally, in writing and with a variety of digital tools; listening skills.
   - **Critical thinking and problem solving** — think critically to design and manage projects, solve problems, make effective decisions using a variety of digital tools and resources.
   - **Collaboration** — work in teams, learn from and contribute to the learning of others, social networking skills, empathy in working with diverse others.
   - **Creativity and imagination** — economic and social entrepreneurialism, considering and pursuing novel ideas, and leadership for action.[38]

Learning Re-structured

Deep learning tasks re-structure learning activities from a singular focus on content mastery to the explicit development of students' capacities to learn, create and proactively implement their learning. In their most effective instances, deep learning tasks are:

1. guided by clear and appropriately challenging learning goals, goals that ideally incorporate both curricular content and students' interests or aspirations.

2. include specific and precise success criteria that help both teacher and student know how well goals are being achieved.

3. incorporate feedback and formative evaluation cycles into the learning and doing processes, building students' self-confidence and 'proactive dispositions.'

[37] "New" knowledge in our descriptions refers to knowledge that is created by the student, whether or not it is new in the broader scope of knowledge that exists. See Guy Claxton, 2013, on "School as an Epistemic Apprenticeship" for this view on the relationship between forms of learning and 'knowledge.'

[38] Fullan 2013a

In deep learning tasks, students also often partner with teachers in designing the structure or process of the task. Many argue that a critical element of such tasks is giving students authentic choice over what they learn and how they execute the learning. Larry Rosenstock, CEO of High Tech High Network in San Diego, California, articulated this idea succinctly in our interview: *"It works through giving them voice and choice."* These tasks define a stronger vision of what it is possible for students to achieve, even at very young ages.[39] It is through deep learning tasks that students in the new pedagogies gain experience in developing their aspirations, in taking the initiative to learn, in learning to persevere through tough challenges, and in doing real knowledge work. In short, these tasks form the practical bridge between learning and doing.

Create and Use New Knowledge

Both in theory and in the practical examples we have seen, deep learning tasks involve *knowledge construction*.[40] Knowledge construction, in our terminology, means students creating knowledge that is new to them rather than reproducing or applying existing knowledge. Kelli Etheredge, a 10th grade teacher from Alabama, described how she used to teach: "I gave them the prepared package of what they needed and if they didn't get it, it was their fault." This process, she said, was how every teacher worked, using the content materials and assessments provided in standard textbooks. Both her role and her students' roles were to reproduce that existing content knowledge. In deep learning tasks, the goal is to develop new knowledge, through the integration of prior knowledge with ideas, information and concepts, into a wholly new product, concept, solution or content. In good deep learning tasks, students also go beyond creating new knowledge to doing something with it – *to using that new knowledge in the world*. In this sense, deep learning tasks have a constructivist orientation, with an emphasis on *the application* of new knowledge in real contexts.

Rhonda Hergott, a seventh and eighth grade math and science teacher at Wellesley Public School outside of Toronto, Canada, described a deep learning task that exemplified this type of knowledge creation. The task was for students, working in teams, to design geodesic domes using a series of different math principles, and then to build the domes out of cardboard for a class of first grade students in the school.[41] Students ran all aspects of the task, from developing the questions they would address, to figuring out the design process, to contacting businesses for the cardboard they needed, and analysing the costs from different providers. During the course of their teamwork, the students decided they would need accurate data, so they measured all the first grade students' heights and analysed their mean, median and mode so they could build domes of the right size. Throughout the task, weekly learning 'checkups' assessed how well students understood a concept taught during a portion of each week (for example, how to calculate the circumference of a circle would be taught the week before they needed to apply it in the project). By the middle of the six-week task, the students were running their own assessments to test their understanding of the concepts. By the end of the task, Rhonda's

[39] See www.youtube.com/watch?v=pGtJami4EGM&feature=youtu.be on what becomes possible through the new pedagogies. Thanks to Bruce Dixon for the language used here

[40] National Research Council 2012

[41] See Rhonda's great Prezi that explains this deep learning task at http://prezi.com/ojjpheqkm0vu/the-geodesic-dome-project/?utm_campaign=share&utm_medium=copy. Rhonda's students also made a video to celebrate their work: http://mshergott.weebly.com/7a-geodesic-dome-project.html

students had covered more strands of the required curriculum than the other two classes of the same age in the school, who were learning through more traditional, textbook-based content. This project was Rhonda's first attempt to carry out a deep learning task in the new pedagogies style. When we asked her about the task's impact, she told us:

> *What that did for me was open up a whole new insight into how students are learning. The students were completely engaged, didn't want to leave math to go to gym or go outside. They wanted to stay and do math, even during lunch period. It wasn't just about building the domes, but about their ownership. They owned it. They owned and guided the process.*
>
> Rhonda Hergott, Grade 7-8 Math and Science Teacher, Wellesley Public School, Canada

Another example of this kind of deep learning task comes from teacher Kelli Etheredge. She described a project where 10th grade English students developed and wrote papers on the environment. They could choose any aspect of the environment they wanted, but had to demonstrate writing and communication skills (aligned with Common Core curriculum standards in the United States) alongside knowledge about the environmental issue they chose. After the papers were completed, students were asked *to do something about* the issue they had chosen, applying their knowledge to a real situation. One group of boys not known for their love for literature class had written about water pollution. These boys negotiated amongst themselves and chose to address Dog River, which was near the school and had become polluted. They developed ideas for a solution and a plan of action. Then they secured a donation of $3,400 worth of advertising from the local newspaper to build awareness of the issue. They got a local coffee shop to make a special coffee blend to raise funds. And two weeks after school was out – note that this is after 'grades' were completed – the kids were out with a local TV station at the river cleaning up the water and describing to viewers what the community needed to do to keep Dog River clean in the future.[42] This example shows us how deep learning tasks require students to make the leap between creating new knowledge and doing something with it outside of school. Through such leaps, students develop more 'proactive dispositions' towards learning and doing.[43]

Key Future Skills

The 6 Cs or key future skills (similar to ISTE's 'NETS' standards for students[44]) are explicitly or intrinsically developed through deep learning tasks. One way tasks do this is through the process of complex problem-solving. Deep learning tasks quite often involve students in working on complex problems that have relevance and impact in the world (well beyond content mastery goals). Deep learning tasks thus often connect students with what Daniel Pink calls 'purpose:'

[42] See the news story: www.fox10tv.com/news/students-clean-up-dog-river-park. The entire task is described here: http://www.pil-network.com/Resources/LearningActivities/Details/e18d2903-9b2c-425d-8f89-5ad42a28d421

[43] However, this example also points to the ambiguity of some deep learning tasks: what were the primary learning goals of the task? Were these goals achieved, and if so, how was the evidence assessed? How does one measure 'proactive dispositions'? Such questions are important to the effectiveness of new pedagogies, and key concerns for teachers seeking to implement the new pedagogies. We address these issues in chapter five, below.

[44] Find ISTE NETS for students at www.iste.org/standards/nets-for-students

Autonomous people working toward mastery perform at very high levels. But those who do so in the service of some greater objective can achieve even more. The most deeply motivated people – not to mention those who are most productive and satisfied – hitch their desires to a cause larger than themselves.[45]

This 'purpose' aspect is also why many deep learning tasks make compelling stories.

Pauline Roberts is a 5th and 6th grade math and science teacher in Michigan, USA. Her students' learning objective throughout the spring of 2013 was to study the hydrosphere through 10 H20[46] Heroes missions. Each mission was structured to develop students' knowledge about different aspects of water. The 10th and final mission challenged students to apply what they had learnt in a way that would have a positive impact on a community. The students describe their project in their wiki for mission 10:

After skyping with our partner teams across the US we decided that we would like to support the Cope Project… The Cope Project is based on helping people in rural Zambia. Only 35% of rural areas have access to a safe water supply. People there suffer greatly from common and preventable disease because of exposure to polluted water.

Birmingham Students' Wiki, H2O heroes

So, after Skyping with the founder of the Cope Project to determine how they could help, the students decided to raise money to fund an ecodome toilet for a village in rural Zambia. They then Skyped with people in Zambia to get quotes for its cost. In the last three weeks of the school year, the students came up with ideas for how they would raise the needed funds. They decided to organise a massive recycling drive; to make unique chairs and auction them online; and to make and sell jewellery from recycled gift cards they collected. The students came up with these rather interesting fundraising plans themselves and carried them out, raising the $2,500 required to fund the toilet. Their reflections on their work in their project evaluation reveals the entrepreneurial skills they developed:

Jewellery

We collected over 2000 cards from local businesses which was good but we only had one disc cutter so it too a long time to cut out the bracelets. Actually making the bracelets took a long time with split rings so we changed to regular rings. We got a lot of orders and spent nearly every lunch time making the orders. We were still making and delivering them on the last day of school! We met with a jewellery store buyer in Birmingham and she is giving us a table at a street event in the summer which is awesome. She asked us to develop a Winter Range and we are meeting with her again in September so that she can decide whether or not she would like to buy them and sell them in her store. We also figured out how to make Guitar Plecks and the guitar store is testing one out to see if they want to buy some.

[45] Pink 2009

[46] You can see all 10 missions here: https://h2oheroes.wikispaces.com/Missions

Students' engagement in this learning work was clear:

> *We are thrilled to have reached our goal but even more exciting was the fact that our principal got so excited about the project that he wants the whole school to get involved and help raise $12,000 for a two wheel tractor which will help the economy of the village we have adopted. He wants teachers and students to visit the village and develop a long-term relationship so we can monitor the impact of our help over a long period of time. Overall, we deem our 10th and final Mission a success! We are H2O Heroes!!!*
>
> Student Wiki, H2O heroes[47]

As Pauline said, reflecting on the project, *"these are 10 to 12 year olds. They did it all themselves. It all came from three words: 'Demonstrate your learning.'"* These students used creativity, communication, grit, problem-solving, collaboration, and self-reflection skills, all while mastering Common Core curricular content learning goals in math and science.

It is important to note that deep learning tasks do not always have to address global problems (although this is an essential component of developing global citizenship). What is critical is that in the everyday curriculum students become engaged in studying and addressing real life issues whether they are local or global.

Another element common to deep learning tasks is that they frequently leverage the social nature of learning through collaborative work. Collaboration in learning is easy to consider on the surface, but tough to do well in practice. One of the most complex transitions for students and teachers to make is the move from a pedagogy that centres on *individuals* demonstrating their learning to a pedagogy that embraces *groups* demonstrating their learning. Yet in modern workplaces, success most often depends upon the ability of everyone to work together to integrate complex parts and ideas into a coherent product, solution, policy or program. This requires individuals to share responsibility for the ends of their work, to make substantive, negotiated decisions together, and to work interdependently.

Here is one example of how collaboration skills were developed through a deep learning task. This task structured learning in teams – as in sports where players pass the ball to each other to move the ball up the field. We observed this task in Kristin Leong's 7th and 8th grade humanities class at Bellevue International School in Washington State in the US. As you will see, the design of the task brought together both US Common Core curriculum standards and several of the 6Cs:

[47] Students' self-evaluation: http://h2oheroes.wikispaces.com/Our+Evaluation with link to new marketing video at bottom of page

The energy in the room was palpable. Students sat in two concentric circles with 'speakers' on the inside circle and 'coaches' on the outside circle. Those on the inner circle were passionately debating Orwell's Animal Farm in relation to Lord of the Flies and the real world. The discussion was so energised that when one person paused even slightly, four or five others would clamour for their voice to be heard. It resembled a heated British parliamentary debate more than a classroom. The literary questions they were debating were the ones the students themselves had developed such as "What makes the animals in Animal Farm think that they are better than the humans?" The teacher sat at her desk off to the side, quietly taking notes on the interactions of the debate and how different students were engaging.

Every student had their book open and they were swiftly flipping from passage to passage in response to the flow of the discussion. Each speaker used different sources of evidence from the text, calling out the page number and the quote to ground their arguments. At "time outs," inner circle speakers would turn around in their seats to face the outer circle. Their personal peer coaches in the outer circle would give them a pep talk about good points they had made or how they could jump in to make their key points more vigorously. Everyone knew their roles, and the students were intently focused on supporting each other. The students not only deeply understood the text, their debate revealed their ability to relate it to the larger historical issues Orwell was addressing.

This was a completely student-led Socratic seminar, with students operating autonomously, peer-coaching, wholly submerged in the exchange and demonstrably having fun. Watching it was very much like watching a high-speed soccer or basketball game. Kristin, the teacher, only intervened to call time-outs. At the end of the session, she engaged the whole class, verbally recognising individual students for exceptional exchanges, focusing primarily on when students had supported each other in the discussions, playing off others' ideas or making good 'hand-offs.' Then students called out their compliments to each other for great points they had made or for excellent coaching or support. The students in this deep learning task were collaborating and working interdependently as peer learners, fully engaged in persuasive and skilled communication with each other. The teacher's role was not that of a distant facilitator – she was continuously engaged in monitoring of the process of learning and used evidence from the debate to provide specific and grounded feedback to students.

Learning Goals

The deep learning tasks described above reveal the full engagement and excitement of students involved in new pedagogies. When their excitement is unleashed through these tasks, teachers and students work together in common purpose to achieve some amazing and powerful results. Deep learning tasks have a stronger potential to affect learning if they are integrated with the teaching strategies and learning partnerships described above. Ideally, deep learning tasks develop both a teacher's pedagogical capacity and a student's learning capacity. The tasks give teachers opportunities to design, implement, monitor, and assess the impact of diverse teaching and learning strategies, and they give students opportunities to practice the learning process, gradually developing their capacities to lead and monitor their own learning and to create and use new knowledge. To do all this effectively, the structure and design of deep learning tasks are of critical importance.

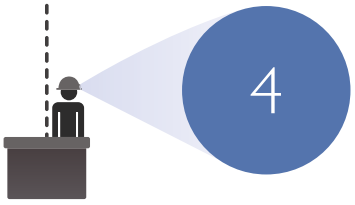
As discussed in Chapter 2, in the section on learning to learn, clear learning goals and specific success criteria provide both teachers and students with a way to assess progress towards learning goals. From Robert Marzano to Charlotte Danielson to John Hattie, pedagogical experts emphasise that effective teaching and learning requires clear learning goals:

> *The more transparent the teacher makes the learning goals, the more likely the student is to engage in the work needed to meet the goal. Also, the more the student is aware of the criteria of success, the more the student can see and appreciate the specific actions that are needed to attain these criteria.*[48]

Thus, deep learning tasks should define clear learning goals, but defining them in isolation is not enough. Optimally challenging learning goals are ones that are within a student's range of near-term cognitive development (i.e., they appropriately push learning progress);[49] are negotiated between and accepted by both teachers and students; and allow for the integration of a learning task with a student's personal interests or aspirations (see also Shechtman *et al*).[50] Furthermore, deep learning tasks must have corresponding success indicators and ways of measuring progress. All of this brings greater transparency to learning progress, helping students to master the process of learning.

[48] Hattie 2012
[49] This refers to Vygotsky's zone of proximal development
[50] Shechtman et al 2013

These new widespread developments naturally raise the question of whether the focus of learning goals for deep learning tasks and the new pedagogies are fundamentally different from the learning goals of the dominant educational models of the last century. If the learning goals are different, what evidence is needed to demonstrate learning? How would we measure success for radically different learning goals? In Chapter 6, we will address what types of new measures of learning progress and outcomes are needed. Of particular importance is whether new assessments can provide evidence of the broader impact of new pedagogies at the whole system level. Before turning to the measurement question, however we need to consider the explosion of digital tools and resources. Such an explosion can trigger more clutter than clarity which is why we need the whole model to guide us: new learning partnerships, linked to deep learning, accelerated by unpredictable technologies, and as we shall see in chapter 6, led by people who appreciate and are skilled at dynamic change processes.



4 The New Pedagogies - Digital Tools and Resources

The third core component of the new pedagogies concerns digital learning tools and resources. Thus far, there has been little explicit description of technology in our accounts of the new pedagogies. This absence is intended, as our primary purpose is to highlight *how the integration of the core components of the new pedagogies can ignite learning in powerful ways*. As Michael Fullan and Katelyn Donnelly wrote in the *Alive in the Swamp* report described above, technology used without powerful teaching strategies (and deep learning tasks) does not get us very far.[51] On the one hand, digital tools and resources have the potential to enable, expand and accelerate learning in ways previously unimaginable, as outlined in *Stratosphere*.[52] But on the other hand, most of the billions invested by schools and education systems in technology have not achieved that potential. Without changes to the fundamental pedagogical models by which teachers teach and learners learn, technology investments have too often simply layered slightly more entertaining content delivery or basic skill practice on top of conventional teaching strategies that focus on the reproduction of existing content knowledge.

Let's start with the present state of digital tools and resources in education. Meta-analyses of the impact of technology on learning outcomes confirm that, up until now, technology use has had a below-average impact on learning relative to other interventions.

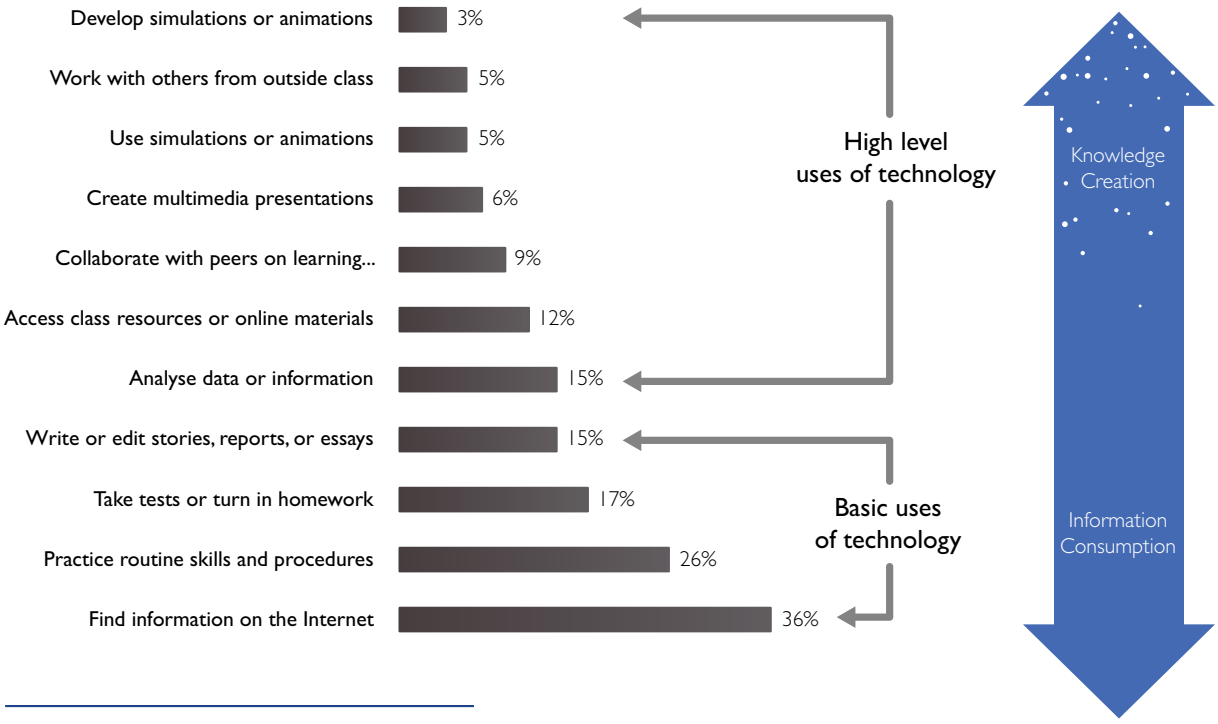
> *Research findings which have been combined in meta-analyses indicate that technology-based interventions tend to produce just slightly lower levels of improvement when compared with other researched interventions and approaches (such as peer tutoring or those which provide effective feedback to learners). The range of impact identified in these studies suggests that it is not whether technology is used (or not) which makes the difference, but how well the technology is used to support teaching and learning… It is therefore the pedagogy of the application of technology in the classroom which is important: the how rather than the what. This is the crucial lesson emerging from the research.*[53]

[51] Fullan and Donnelly 2013
[52] Fullan 2013b
[53] Higgins et al 2012

John Hattie found a lower than average impact of technology on learning in his meta-analysis, relative to other teaching and learning strategies.[54] Larry Cuban[55] has documented that technology has had little impact over the past 50 years. In these projects and in Michael's *Stratosphere*, the reason for this non-event is fairly clear: technology in education thus far has been primarily premised on traditional pedagogies. Orrin Murray and Nicole Olcese at Pennsylvania State University analysed the 30,000 applications categorised as 'educational' in Apple's iTunes U. In their final analysis, they concluded that "among applications categorised as 'educational', few, if any, provide more than consumption modes."[56] Those that go beyond such content delivery and consumption approaches were described as mostly 'drill and practice,' or the repetition of basic skills. This characterisation holds true not just for Apple's educational applications but for the majority of educational applications of past decades. Even the highly-touted Khan Academy or the emerging MOOCS, as valuable as they may be for supporting traditional learning goals, do not begin to leverage technology for new pedagogies and deep learning in the ways we are talking about.

Not only are the technologies themselves premised on traditional pedagogies, the ways teachers have been using technology with students are more about delivery than about creativity. The current use of technology inside schools and classrooms rarely leverages digital tools and resources for deep learning. As Luis Fernandes, Director of the Freixo School Cluster in Portugal told us, *"Technology is important. But it is not going to solve the problem if the teachers are not using it in powerful ways."* The following chart from the Innovative Teaching and Learning Research project shows how teachers across seven countries report on the way that they ask their students to use information and communications technologies:

Figure 7: Technology Use and Knowledge Creation



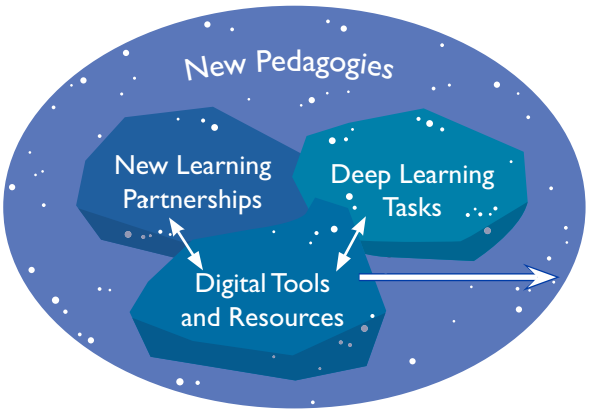
[54] Hattie 2009
[55] Cuban 2013
[56] Murray and Olcese 2011

As this data from 2011 show, technology is still primarily used in basic ways that layer technology on top of traditional teaching and learning, rather than for collaboration and knowledge creation. Moreover, even this chart does not get at the deeper forms of knowledge creation that will evolve with the new pedagogies over the next period.

Let us examine a concrete example of a school that put learning and pedagogy first and then used technology in support of those. We consider here Park Manor Public School (grades 6, 7, and 8) in Elmira, Ontario.[57] The school focused first on student learning goals, second on precise pedagogy, and third on how technology could enable and accelerate learning in high level standards. Teachers collaboratively designed an 'accelerated learning framework' that mapped how student learning goals, deep learning competencies, exemplary pedagogy and technology all work together. Then they began to practice using this framework school-wide, bringing clarity to intentions, processes and tasks, and desired outcomes. They developed a targeted 'professional learning and professional practice' strategy that embedded effective use of technology within the framework. The result: after being essentially flatlined on learning achievement, they dramatically improved on the annual standards measures. Reading proficiency, for example, climbed from 72% to 93% in three years, and writing improved from 69% to 87%, including closing the gap for boys compared to girls.

For Park Manor and other schools like it, technology is used as an enabler and accelerator of the other core components of the new pedagogies. In the new pedagogies model, technology directly supports the new learning partnerships and it becomes the foundation of deep learning tasks. In short, it makes a whole new kind of teaching and learning possible.

Figure 8: Digital Tools and Resources



Enabling new content discovery, local and global collaboration, and the creation and use of new knowledge in the world.

Accelerating teachers ability to put students in control of the learning process.

[57] See the work and accelerated learning framework explained at Park Manor at Fullan 2014b and Motion Leadership Film Series, www.michaelfullan.ca/ontario-park-manor/

Technology, strategically integrated with the other core components of the new pedagogies, *unleashes deep learning*. When pedagogical and deep learning capacities are clearly defined and developed, digital tools and resources enable the: 1) discovery and mastery of new content knowledge; 2) collaborative, connected learning; 3) low-cost creation and iteration of new knowledge; 4) use of new knowledge with authentic audiences for "real" purposes; and 5) enhancement of teachers' ability to put students in control of the learning process, accelerating learner autonomy.[58] As the rest of this chapter will elaborate, in the new pedagogies, learning partners use technology to construct knowledge, to investigate and solve real problems, to give each other feedback and assess one another's work, to collaborate beyond the boundaries of the classroom and the school day, and to communicate with peers, experts and others throughout the world. These uses of technology are not merely additions layered on top of curricular goals. Instead, technology is used in the name of deep learning goals with well-defined success criteria. The 'how' of its use is dynamic and co-determined by students and teachers. When this occurs, what happens through formal schooling begins to truly connect with the way the world works outside schools. The boundaries to the outside not only become permeable, in a learning sense *they disappear*.

Don't start with the technology. Start with pedagogy and let the students help you see how they'll fit technology into effective teaching and learning.

Max Drummy, Professional Learning Leader, Department of Education, Tasmania, Australia

We were so excited about some of the great apps and great technology, and then we started to realise that it was the simplest forms of technology that are the most profound.

Liz Anderson, Grade 6 Teacher, Park Manor, Ontario, Canada

New Content Discovery

The history of education is at an extremely important inflection point. The tremendous teacher and student excitement around 'blended learning' and the 'flipped classroom' springs from a common source of pain. Teachers and students in most school systems around the world have long been constrained by the need to 'cover the content' mandated by extensive curriculums and the focus of most formal assessments. Ubiquitous access to digital tools and resources, however, makes virtually all content knowledge available to everyone, at any time. This means two things. First, teachers no longer have to deliver broad swathes of content knowledge personally.[59]

[58] Thanks to Peter Hill for the language here

[59] This does not negate the need for teachers to have deep knowledge of their specialisation to guide student discovery, creation and use of knowledge that is most often new to the student. Furthermore, this different relationship to content opens the door to more cross-disciplinary learning tasks. Just as solving problems in the real world usually involves synthesising different information, ideas or perspectives, deep learning tasks are most often multi-disciplinary

Second, schooling does not have to be so much about delivering all the content a student might theoretically need in life. Although students' breadth of content knowledge is important, teachers and schools should not have to deliver all of it. Learning can become more focused on helping students *master the process of learning* and helping students discover and master new content knowledge themselves using digital tools and resources.[60] While this scenario decreases the need for teachers to directly deliver content, it increases the need for very high quality digital learning resources that are easily accessible and user-friendly. And it expands the scope of what is required – excellent learning resources are needed not just for the 'required curriculum' but for the whole vast world of knowledge and ideas.

Collaborative, Connected Learning

Pervasive access to digital tools and resources makes deep learning more possible through broadening the time and space in which students can connect with teachers, peers and others for idea generation, feedback, expertise and the assessment of progress. This inherently makes the learning process more social, which connects the learning process with modern research and theories on how people learn.[61] For peers working together on a learning task, the ability to collaborate using digital tools outside formal school hours also expands the chances to pursue learning connected to personal interests and aspirations. When integrated with the other core components of the new pedagogies in the formal learning process, online learning resources become tools not only for isolated learning by highly motivated students, but tools that enable more inclusive, socially-connected learning *for all students*.

New Knowledge Creation

We described in the previous chapter the essential role of knowledge construction in deep learning tasks. Will Richardson articulated this idea of connecting the use of digital tools and resources with the creative imperative: "Technology allows us to make intellectual leaps and create things of true beauty and meaning and value as opposed to using it [only] to communicate and manage student learning plans, or 'deliver' learning beyond the time and space constraints of the classroom."[62] Productivity in the knowledge-based, value-creation-oriented global economy of the 21st century requires individuals who can create new ideas, new products, new solutions and new content. Similarly, deep learning requires more than content mastery – it requires the creation and use of new knowledge in the world. Certainly many of these things can be created without technology, but digital tools and resources make the creative process more feasible for students, at significantly lower cost. Whether it is a video, a multi-media presentation, a visual display of a quantitative analysis or even a well-researched, up to date report that incorporates global data and expertise – when students use digital tools and resources to practice the knowledge construction process, they are practicing in the way that they will be expected to work in the future.

[60] See Sugtra Mitra in this short video, describing the need to develop students who can navigate content well: www.youtube.com/watch?v=qC_T9ePzANg

[61] Bransford et al 2000

[62] Will Richardson, personal email exchange with the authors

New Knowledge Use in the World

This is the final step of deep learning: using new knowledge that has been created by students in the world beyond school. In this step students fully develop and build their proactive 'doing' dispositions. For example, Amanda Henning, Assistant Principal at Dallas Brooks Community School in Victoria, Australia described student voice projects, saying, "I think the 'take action' phase is the most important as far as student voice, because that is the phase where students are able to have total control."[63] It is one thing to make a new knowledge product and share it with a teacher or other students. It is quite another thing to put that knowledge out into the world to solve real problems, to be used by authentic audiences, or to influence real policies or programs. For the past century, schooling has largely been contained within classroom and school walls, and students who graduate have acquired great skills in conforming to the learning expectations defined by others: doing what they have been *instructed* to do. But today, when those students go into the workplace and the wider world, they are suddenly confronted with the expectation that they need to do very complex things *without any instructions*. Schooling today thus fails to fully prepare our young people for their futures.

Only through transforming expectations of what students *should and can do*, and giving them practice at doing these things in the world, will our schools succeed once more in their fundamental mission. This is about helping students to build attitudes and confidence through doing purposeful things that make a difference in the world. When John Dewey said that schooling is not a preparation for life but, rather, *is* life, he could scarcely have imagined that students would one day learn about the world by learning to improve the world from a very early age—thereby becoming great citizens for life.

> **"It is about helping students to build attitudes and confidence through doing purposeful things that make a difference in the world"**

What is the role of technology in this? To put it simply, digital tools and resources have become one of the primary ways people *do things* in the world today, and our young people need experience of working in this way. They will be entering a world where jobs will rarely be provided to them; instead they will need to create and demonstrate value in the world. Digital tools and resources enable and accelerate such value creation, and they are pervasive in the world outside school. It is time to bring these resources into schools so that students can use them to do things. And we should set the expectation that such 'doing' is not only possible, it is required.

This way of looking at how technology should be used in the learning process has implications for the kinds of digital tools and resources provided to students. The emphasis here is not so much on enabling personalised learning through technology (where the inherent goal is content mastery). Instead, from this perspective, the emphasis should be on providing every student with the digital tools and resources to discover, create and use new knowledge.

[63] See projects like deforestaction at Dallas Brooks Community School: www.youtube.com/watch?v=j2HwGcOcpKM

Accelerating Learner Autonomy

In new pedagogies we are beginning to see how technology can be used to support the new learning partnerships between and among teachers and students, and to accelerate teachers' abilities to put students in control of the learning process. The ultimate goal of new pedagogies is for students to become independent learners who are able to design and manage the learning process effectively for themselves. Achieving this goal is not simple or easy, and it requires sophisticated pedagogical capacities that develop students' mastery of the learning process over time. Digital tools and resources can offer support by making the learning process more visible to all stakeholders. To state this succinctly, *student-teacher learning partnerships and the deep learning tasks they generate should govern how digital resources are used.*

> "The new pedagogies goal is for students to become independent learners who design and manage the learning process effectively"

Technology can powerfully support the new learning partnerships, as we are seeing in the schools discussed in this report. For example, Park Manor, with its pedagogical foundation intact, clearly uses technology to accelerate the learning partnerships that are flourishing in the school. This does not always involve high tech usages. Their use of 'stickies' (post it notes) to put the faces to student data on the walls of the staff room and to capture how each student is progressing is a wonderfully simple and effective way to make learning transparent.[64] Other schools use technology more directly. Hellerup School in Denmark uses e-portfolios to collect and track student work. All teachers working with a student in the school provide information about the student's progress in the portfolio – both in academic and in non-cognitive domains. Student work is collected in them but, more importantly, teachers contribute to and develop a multidimensional view of individual students through the use of this system, which includes descriptions of the learning strategies that work best for a given student. This information can be accessed and further developed by teachers new to the student, reducing the time required for a teacher to come to understand a student's needs and interests. Students can access their own portfolios as well, to participate in their own description and reflect on their own learning strengths and areas for development. Mette, the teacher we interviewed from this school, described the rationale: "We need to see the child all the way around."

Another example of how technology can support the new learning partnerships is through digital tools that capture students' aspirations and learning goals in relation to their actual work, their learning progress and their ongoing engagement. A combination of e-portfolios with aspirations and engagement allows students, teachers, parents and other learning partners to provide more effective feedback and to see students' learning progress more clearly. One of the few examples of this type of digital tool is the My Aspirations Action Plan (MAAP) developed by the Quaglia Institute for Student Aspirations. This tool provides an online platform for students to define their own learning goals in relation to their aspirations, track their own progress

[64] See teachers at Park Manor discussing how they use this system: Fullan, 2014, Motion Leadership Film Series, www.michaelfullan.ca/ontario-park-manor/

against those goals, and share their actual work products such as papers, videos and other artifacts of learning they have created. This system opens up the learning process for teachers and leaning partners to access, continuously monitor and support a student's learning. It helps teachers to know all of their students better and, through this, helps them build their students' learning capacity.

All of this action (and turmoil) raises major questions about how to assess what is being learnt. It exposes the fundamental weaknesses of traditional tests and poses vexing questions about new assessments. While this can be cast as a problem, in truth it creates new opportunities to focus on what can be learned and measured in the new era and on how addressing this issue can reverberate back and help us better define the new pedagogies. So, now we have learning partnerships, deep learning and accelerated digital innovations in the equation. How do we assess this pot-pourri of opportunity?

5 Measures for Effective Vs. Ineffective New Pedagogies

In the previous chapters, we have shown the potential for the core components of the new pedagogies (new learning partnerships, deep learning tasks, and ubiquitous access to digital tools and resources) to unleash a new learning energy and excitement in students and teachers. We have argued that when the components all come together, they shape a new model for education to achieve deep learning ends more relevant to this era. But a critical piece of the picture has not yet been addressed. How do we know when these pedagogies have achieved their goals? How do we assess and measure outcomes? How do we evaluate more and less effective versions of the new pedagogies? In this chapter, we present an initial model for measuring more and less effective versions of new pedagogies.

The Present Landscape

In our interviews with teachers and school leaders on the new pedagogies, we heard a lot about the issue of the weakness of our current systems for measuring student learning outcomes, teacher quality and school performance. Among all the educators with whom we spoke, there was unanimous consensus that assessment practices and systems must change. Teachers say that the kind of deep learning that new pedagogies foster cannot be assessed by traditional standardised exams:

> *I think assessment has to change too. We need to change assessment because right now we're assessing knowledge that they could find on the internet. I think quality is going to be what these kids are capable of demonstrating vs. what they can remember. How can they solve problems, create things, collaborate?*
>
> Dianne Fitzpatrick, Cross Curricular Head of Instructional Technology, Central Peel High School, Canada[65]

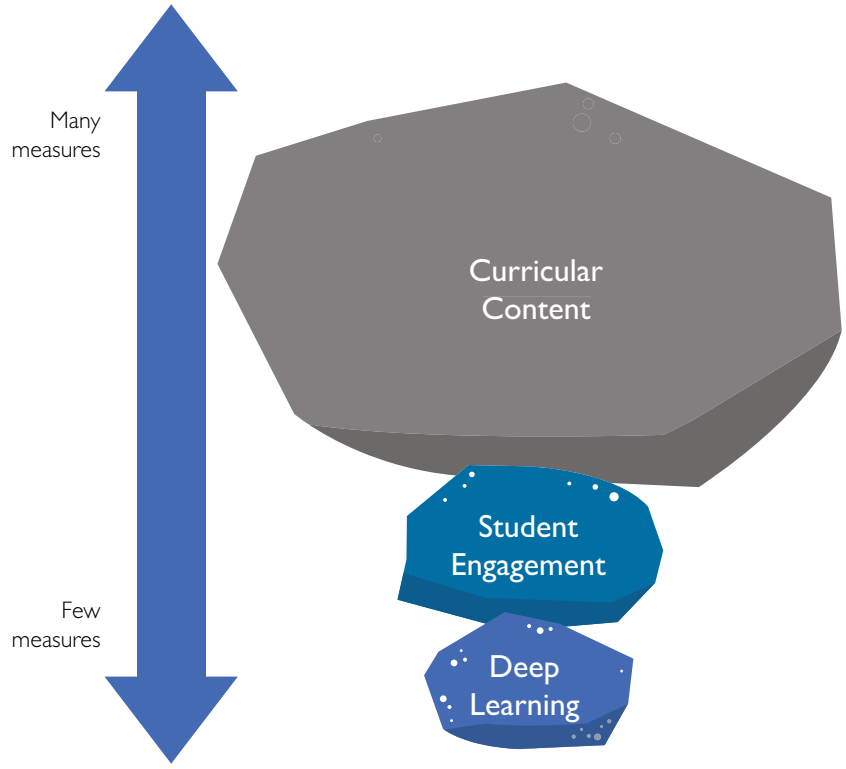
In most of the schools and education systems we have observed, *the only student learning outcome measures available for accountability purposes are measures of curricular content mastery*.

> *In the old pedagogy, you measure only content. As long as we keep measuring only content, we are setting students to learn just that. They need to have freedom to expand that content even further and be challenged to come up with new ways to do so.*
>
> Erika Twani, CEO, Learning 1 to 1 Foundation

[65] See the story of Central Peel High School's journey: Fullan 2014, Motion Leadership Film Series, www.michaelfullan.ca/ontario-central-peel/

The current assessment landscape is represented in the figure below, where the size of each circle represents the availability of existing assessments:

Figure 9: Availability of Student Assessments



New pedagogies aim to improve outcomes on a number of fronts, from content mastery to student engagement to deep learning outcomes. We need to be able to measure all of these elements in a common and integrated measurement system. Indeed, we believe that through such combined measures the false dichotomies between traditional and deep learning that Sir Michael Barber often refers to can be overcome. We agree wholeheartedly with the position articulated by Guy Claxton:

> *… there is a fast-growing global tendency to cast the fundamental purposes of education in terms of the cultivation of useful, transferable, culturally appropriate 'character strengths' or 'habits of mind'; and that this leads most productively to the search, not for 'more team games and orchestras', nor for add-on courses that address 'moral development' or 'learning to learn', but to a refocusing on the methodology of 'normal lessons'. Concern with 'character education' or 'key competencies' should not lead to a neglect of difficult subject-matter or challenging projects, but to the clear recognition that the main reason for grappling with them is to build the skills and the confidence to grapple.*
>
> Guy Claxton, 32nd Vernon Wall Lecture, "School as an Epistemic Apprenticeship: The Case of Building Learning Power"

Theoretically, at the end of learning experiences with new pedagogies, students should breeze through standardised tests that measure mastery of curricular content. Of more importance would be measuring the full range of students' deep learning competencies: 1) students' mastery of the learning process, including their ability to master new content; 2) students' key future skills, including their abilities to create new knowledge using the collaboration and communication skills necessary for high-level value creation; 3) students' proactive dispositions and levels of perseverance in the face of challenges; and 4) the effect of students' work products on intended audiences or problems. Technology can theoretically be harnessed to support all of these types of measures, but we have so far seen few clear examples of this happening.

New Measures of New Outcomes

As we have seen in the deep learning tasks described in previous chapters, in lieu of holistic new assessment models for deep learning, many teachers are already developing their own ways to assess some key future skills and deep learning outcomes. In many of the deep learning task examples that we have seen in action, learning goals and success criteria are defined in advance of task implementation, using rubrics that explicitly define levels of success for each learning goal. Such rubrics are often co-created by students and teachers, or designed by students and reviewed and refined with teachers' guidance. In the hydrosphere "missions" projects that Pauline Roberts' students carried out in Michigan, each mission was guided by explicit success criteria defined through rubrics. For example, here is one section of the rubric for mission #6:

Table 3: Student Assessment Rubric for H20 Heroes Mission #6

Needs Improvement (0-1)	Satisfactory (2-3)	Excellent (4-5)	Score
Final Product			
Content			
• Some content is not accurate • Only included 1 or 2 of the mission requirements	• Most of the content is accurate • Described how water exists below Earth surface • Described how groundwater moves and how it is replenished • Included 2-3 examples of how groundwater can be polluted • Gave 2-3 examples of different land uses • Mentioned that land uses leads to pollution but didn't give specific examples • Identified 2-3 ways in which groundwater pollution can be reduced and cleaned up • Identified 2-3 reasons why we should care about groundwater	Your team accurately included all mission requirements: • Described how water exists below Earth surface, includes visuals and vocabulary: saturated zone, water table • Describe how groundwater moves and how it is replenished (Included use of vocabulary: porosity, permeability, aquifer) • Included at least 4-5 examples of how groundwater can be polluted • Identified 4-5 ways in which groundwater pollution can be reduced and cleaned up • Identified 4-5 reasons why we should care about groundwater	
Creativity			
The final product: • Was predictable • Included mostly text • Had few interesting features • Did not catch the viewers attention	The final product: • Had some interesting features • Included parts that were eye catching • Included some pictures or graphics	The final product: • Interesting and eye catching • Caught the viewers attention • Made your audience think • Included pictures or graphics	

The correct use of content knowledge is the first dimension of this rubric, followed by indicators of success for the key skill of 'creativity.' This approach provides an embedded assessment framework that is aligned with the specific context of this deep learning task.

More often than not, these kinds of rubric-based assessments involve analysing the quality and rigour of the products students create as part of deep learning tasks, and assessing the process through which those products were produced:

Where the teacher has a fundamental role to play is in the products that the kids produce. In the kinds of products and the quality of that product, and to make sure that the communication skills that they are using, and a variety of different aspects, represents what we believe kids at that age and stage should be able to do.

Hazel Mason, Superintendent, Peel School District, Ontario, Canada

Other teachers and school leaders we interviewed also described great examples and approaches to assessing new pedagogies' impacts. For Rhonda Hergott's students, the final assessments involved whether the geodesic domes they produced were functional (did they work in the real world?), although the entire process had weekly "minds-on" mini-assessments to ensure the appropriate math concepts were mastered. In Kristin Leong's Socratic seminar, the students were entirely responsible for assessing each other's contributions. Mette Hauch's students in Denmark make oral presentations of their learning in literature and math to a committee of teachers, who then have a conversation with the student to push the thinking further. In the Fontan schools in Latin America and the United States, students collaborate with their educators to evaluate their own learning progress and to relate what they have learnt back to students' own lives and contexts. At Larry Rosenstock's High Tech High in San Diego, public exhibitions of students' work products have become a school tradition. He said, "you have to make work public – it's absolutely critical to have public exhibitions. Standardised scores are not used in the real world." They have thousands of people each year who come to their exhibitions.[66] These examples of assessment used in new pedagogies not only capture content knowledge mastery, but also prepare students for life beyond school.

However, these embedded and authentic approaches to the assessment of students' work require a high level of *assessment competency* on the part of teachers. Such competency is hard to develop, especially when many teachers around the world have been trained to rely on assessments developed externally, by curriculum boards or textbook providers. Assessment approaches for deep learning also need to become comparable across different types of tasks, subjects, schools and systems:

One of the greatest challenges for the developers of transformative assessments is to design new, robust, comprehensible and publicly acceptable means of scoring student work.[67]

[66] By way of 'measures of deep learning' students from High Tech High have published 64 books, have 2 patents, and last year a former student was the creator of the hottest selling toy on Amazon during the Christmas holiday season.

[67] Redecker and Oystein Johannessen 2013, also citing Ripley 2009

This lack of validated comparability of new assessment of deep learning means that such measures have rarely been used beyond individual projects or classrooms for the accountability measures required of school and system leaders. In a few countries, schools are beginning to measure student engagement and school climate, and there are a number of validated instruments and systems for doing so available now, such as the My Voice system and the Tripod surveys. But this type of measurement has not been done consistently across whole education systems, and thus they are not yet accountability measures that can be used by policymakers. Neither have such measures been consistently integrated in a holistic measurement system that measures pedagogical practices, student engagement and deep learning outcomes.[68] Making assessment much more intrinsically formative is a starting place, as it would develop students' capacity for incorporating feedback in ways that are much more like how performance is measured in non-school contexts.

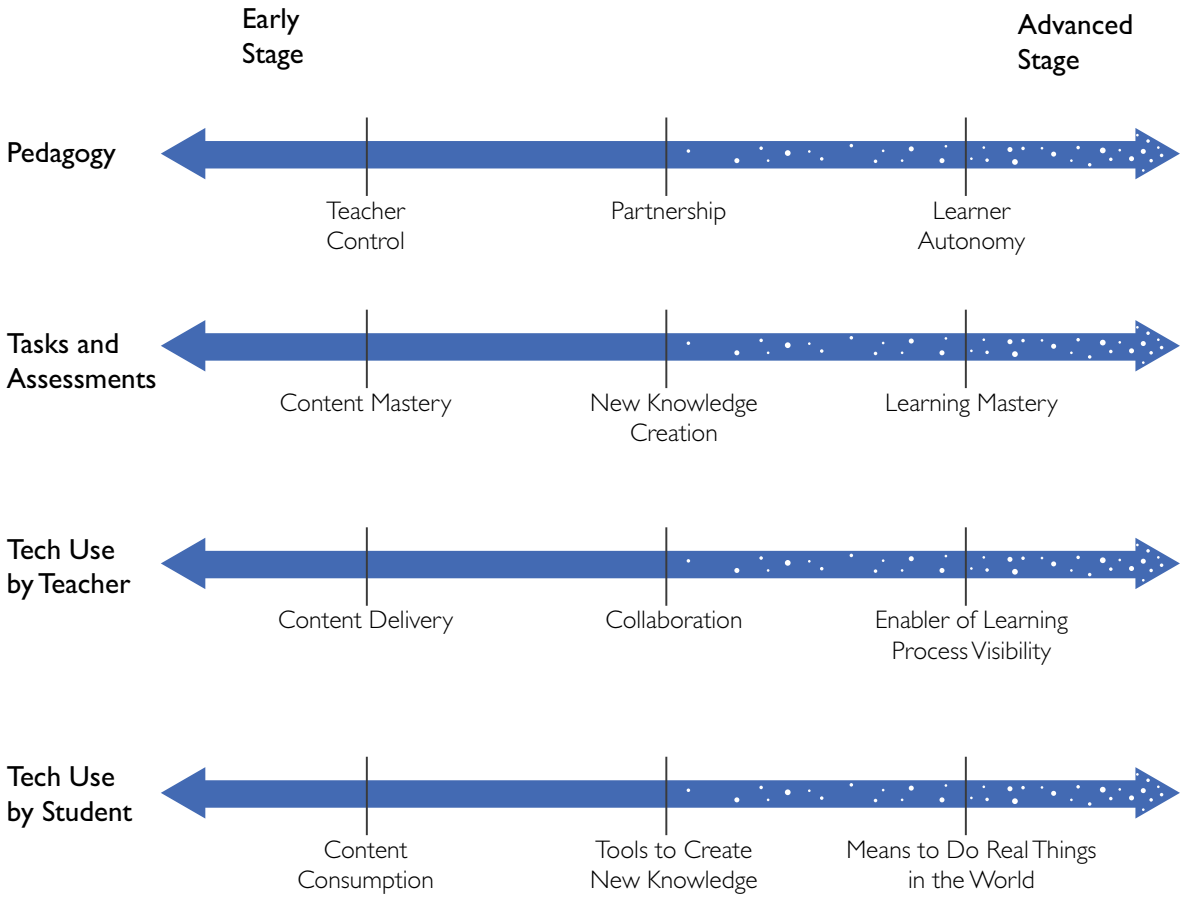
We need to develop measures for both deep learning outcomes and for the new pedagogies and learning environments that support them. A whole system of new measures would involve measuring diverse elements of the learning process and environment, such as roles and relationships, school climate conditions, learning task designs, the frequency and calibre of formative feedback, teacher and student engagement, teacher professional learning, the speed of students' progress towards specific learning goals, school leadership, system resources and policy alignment, and, ultimately, students' mastery of the learning process itself. Measures of inputs, outputs and outcomes should all be a part of a holistic and aligned system of measures that can support deep learning. From a system and policy perspective, such new systems of measures remain critical necessities.

Effective vs. Ineffective New Pedagogies

Such a new system of measures could begin to provide insights into the effectiveness of different variations and implementations of new pedagogies. While we have been impressed by the number of seemingly spontaneous examples of the new pedagogies that we found, there is also a lot of ambiguity about what they should include —though this report has begun to provide clarity in this respect. It is easy to get swept up in the euphoria and fail to pay close attention to executional excellence. Based on the analysis of new pedagogies developed in this report, we have identified dimensions of an initial model for analysing the effectiveness of new pedagogies in practice. We present these dimensions as continuums of effectiveness, recognising that the new pedagogies build upon current models of practice.

[68] Conley and Darling-Hammond 2013

Figure 10: Continuum of New Pedagogies Effectiveness



On this continuum, more effective new pedagogies would be characterised by the advanced stages on the right, although the middle stage might be a necessary stage of development. Here, teachers are learning partners with their students, dynamically activating their students to push them further along their learning paths, and helping students think more clearly about their learning goals and how well they are doing in achieving them. This leads to learner autonomy, but the teacher is a necessary partner along the way. Learning tasks shift from content mastery to creating and using new knowledge in ways that impact the real world. Technology is used in ways that enable teachers to see students' learning progress and allow students to experience creating and using new knowledge with purpose. For a summary, consider the following table:

Table 4: Effective vs. Ineffective New Pedagogies

Effective New Pedagogies (High Levels of Pedagogical Capacity Needed)	Ineffective New Pedagogies
• Establish students and teachers as co-learners • Long-term deep learning tasks; cross-curricular; complex, interdependent tasks • Deep learning tasks have clear learning goals and clearly defined measures of success • Give students control and choice suited to their level, gradually building students' capacity to manage the learning process • Continuous, effective feedback; formative assessment towards the learning goals • Identify and use digital tools and resources to support deep learning tasks and to help students master the learning process. Analyse progress data to inform changes in teaching and learning strategies	• Too much student autonomy • Short-term tasks for one unit or lesson; not multidisciplinary • No clear learning goals or ways of measuring success • Give too much control and choice to students before they have skills to structure their own learning effectively • Ineffective feedback or only summative assessment at end of task • Use digital tools and resources only to deliver content and track progress, but not to inform changes in teaching and learning strategies

In its effective versions, new pedagogies should help students develop over time as independent, autonomous learners able to effectively design, pursue and achieve their own learning goals and personal aspirations as well as master curricular learning goals. But this doesn't happen by itself. The ultimate goal for teachers, as John Hattie has described, is to "help students to become their own teachers."[69] In schools where the new pedagogies are taking hold, we see examples of this visibility becoming part of normal practices. Dan Buckley, deputy head at Saltash.net School in England, described one such example. Saltash.net Community School implemented a student-led evaluation system a few years ago. Each year students are given two days to collect all their data by gathering their assessment scores, interviewing peers and teachers, and reflecting on their own work and progress. Then they present their personal progress story to an audience that includes their parents and teachers, describing what they are good at, what their learning goals and expectations for the year were, how well they achieved those goals, and outlining what they plan to work on next. The result, Dan pointed out, is that "students set much higher expectations for themselves than I or any teacher I know ever would." Practices like these – at the heart of new pedagogies – unleash higher expectations for learning. When high expectations are supported by the higher levels of self-esteem developed through learning partnerships, more successful learning becomes inevitable as was suggested by Sir Michael Barber over a decade ago:

[69] Hattie 2012

Figure 11: Expectations and Self-Esteem[70]



In summary, the new pedagogies must develop new measures that assess new learning outcomes as well as the practices that lead to such outcomes. Attempts to assess so-called 21st century learning skills that are detached from actual teaching and learning practices will be of limited use. Assessment is the weakest part of the new pedagogies model we have presented in this report. We expect further action in this domain, and would recommend that three sets of variables be the focus of this work: new assessments of the deep learning outcomes; identification and assessment of the nature of the pedagogical partnerships that will best produce these new outcomes; and finally a consideration of which policies and strategies are necessary to generate the new pedagogical partnerships in question. We ourselves are currently reviewing, developing and will be applying specific measures of deep learning in our new pedagogies initiative with 1,000 schools.* All in all, while a few new directions are beginning to gain traction, holistic systems of new measures are badly needed to inform this work.

The bottom line is that the issue of new assessments is at the very early stage of development, and represents a major challenge in the immediate future. In this sense it will be easier to generate instances of new pedagogies than it will be to figure out how to assess them. These two domains—pedagogical innovation and assessment of learning must go hand in hand. Thus, the next phase must be marked by identifying and developing measures of the deep learning outcomes and the pedagogies that produce them.

[70] Barber 1997
* www.newpedagogies.org

6 The New Change Leadership

Educators are inspired by their students' learning – when they see it, they are motivated.

Erika Twani, CEO, Learning 1 to 1 Foundation

With the previous chapters we sought to show that the three core components of the new pedagogies—learning partnerships, deep learning tasks, and digital tools—have the potential to transform learning. Students become life-long learners by learning about life as they live it and then seek to improve it. Everyone becomes an entrepreneur in the sense that they do something worthwhile (in business, global justice, or other areas) with whatever resources they have and can generate. All of this happens through new pedagogies that make new things possible in the realm of learning. In this section, we consider how this vision can be rapidly achieved across whole education systems. This will require a different change process, and thus a different kind of leadership. What are the new roles for leaders? What are the enabling conditions that support the effective implementation of the new pedagogies? Note also that this must happen on a large scale – whole systems. Let us start with one education system that has begun the change process in this direction.

The Peel District School Board near Toronto, which oversees 250 schools and 150,000 highly diverse students starts down the path of integrating pedagogy and technology. They have the usual starting point – bored students, and teachers struggling with their frustration and disillusionment. Until 2011, the district was a traditionally-run system of strategic plans and uneven implementation.

A new central leadership enters the scene and taps into an emerging combination of ad hoc leaders at the district and school levels who are ready for something different, though they don't know what that is. School leaders start to identify teachers who are beginning to do some interesting things with their students or who have expressed the desire to move in new directions.

The school board passes a BYOD (Bring Your Own Device) policy and invites schools and the system to figure out implementation. This is the beginning of a disruptive period. Initial reactions are mixed among principals. In some schools new conversations — now both face-to- face and online – happen among teachers and school leaders and between schools and the district. In these schools, the pedagogical roles of teachers and students begin to change and excite people beyond anything they have experienced. Some teachers change their minds about leaving the profession; some students begin to love school in a way they never have. In other schools, however, principals and teachers feel cut adrift.[71]

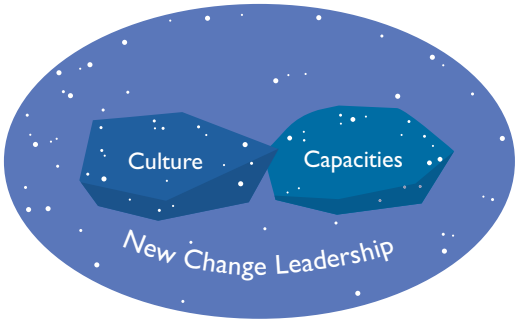
[71] Video of the Peel story: Fullan 2014, Motion Leadership Film Series, www.michaelfullan.ca/ontario-peel-district-school-board/

These new change leaders will have to operate under conditions of dynamic change. We see the process as consisting of: directional vision, letting go, and reining in across iterative cycles. Such leaders will need to open up the possibilities with directional ideas but not necessarily concrete plans at the early stage. As this "invitational stage" unfolds, leaders – again at all levels – will need to be open to new explorations while supporting people under conditions of ambiguity. In this sense, leaders 'let go' as new ideas and practices are explored, which happens in rapid order. As the process unfolds, leaders will need to help others identify, refine and spread what is working. This is a change process of the likes we have never seen, and a major theme of it is the rapid inclusion of more and more partners in the process.

A New Change Process

Peel is significant because it is an ordinary district with a large number of schools, none of which have extraordinary resources. As a group, they represent typical publicly-funded schooling. The Peel story is an example of what we are beginning to call *Inherent Change*. *Inherent Change* is when change happens almost organically. The story of Peel highlights the challenges facing new change leadership. We say 'almost' because, as we shall see, the roles of leaders and the enabling conditions they foster are essential. Under the right conditions, inherent change can occur more rapidly and more easily than anything we have seen before in complex systems. This is how the new pedagogies' change process is different: it is faster because its fundamentals are natural to the human condition. It is built on humankind's need to a) be doing something intrinsically meaningful, and b) to do it socially (i.e., with the group).[72] The metaphor that comes closest to capturing this system dynamic is 'positive contagion.' We see this dynamic currently underway, albeit at the different stages in different contexts. For systems where people are ready and there is the possibility to change essential enabling conditions, dramatic transformation will no longer take 50 years. It can take less than two years to begin to take hold in some schools, as we are seeing in the case of Peel. We predict that the new pedagogies for deep learning will spread rapidly in the next period because of the convergence of forces that we have identified in this report.

Figure 12: How the New Pedagogies Spread



Inherent change is efficient, reaches everyone, motivates from within, cultivates group ownership, and has built-in sustainability. It is organic change for complex human systems. The model of organic change is useful because, in organic systems, under the right conditions, change can spread quickly and existing systems can be transformed in very short periods of time. In education systems, when the right learning conditions are in place, there can be a natural and organic adoption of new pedagogies by students, teachers and other stakeholders throughout the system. But the conditions and capacities of the educational ecosystem regulate the ease and speed with which change occurs. Leadership, culture, accountability and assessment measures, professional learning, digital resources and the policy framework of the whole system: all of these constitute key

[72] Pink 2009; Brooks 2012

conditions that influence the rate of spread of new pedagogies and the effectiveness of their implementation. We will describe these conditions in more detail below, along with the roles of leaders in these processes.

Catalysts of change can come from different sources. In our observations, the new pedagogies take off most quickly when three conditions are in effect simultaneously: 1) there is a confluence of student disengagement, teacher discontent, and leadership accountability pressures; 2) students have access to technology outside of school that allows them easy access to a vast amount of information and ideas; and 3) new technology investments and new policies are underway or under consideration inside the school system. It is both exciting and confounding that change towards new pedagogies is taking place in whole education systems in diverse parts of the world from Ontario to Tasmania to Colombia. What is different today is that *the external contexts in which schools exist are becoming more* conducive to the confluence of new pedagogies (partnerships, deep learning tasks and pervasive digital resources). As we have argued above, the ubiquity of technology outside schools changes the dynamic for the delivery and mastery of content knowledge. At the same time, organisational models are changing from bureaucratic command and control hierarchies to models that support the new pedagogies, focused on mastery of a dynamic learning process.

As has been well studied and researched over the years, there are many well-known barriers to educational system change.[73] One of the most frequently-cited barriers is the perceived resistance of teachers to adopting new practices or tools (the research also shows that there are often quite good reasons for this resistance).[74] This is where the new learning partnerships between teachers and students can provide a powerful influence. Our colleague Dan Buckley at Saltash.net Community School in Cornwall, England, told a story that reveals the pull of student voice in one teacher's adoption of new pedagogies. Saltash.net is a school known internationally for its innovative integration of technology. However, not all of its teachers have embraced technology, and a few remained extremely sceptical about the ability of digital tools to really support learning. Dan was interested in the question of how every teacher, no matter how reluctant, could begin to develop and integrate technology. As a thoughtful leader he came up with a student-driven model. He arranged for each student in a few classes to have a device, and required only that teachers allow these students to use the technology in their classes. He also set up a team of 'student experts,' who observed how the students were using the technology for learning and identified the best examples. Quite surprisingly, one of the best examples this team identified came from the class of a teacher who was well known for her resistance to using technology. She had responded to the requirement that students use their devices by throwing up her hands and saying, essentially, "I don't know how to do this. You students will have to figure it out." And so they did. She let the students drive the technology use completely, let them run with the challenge of applying it to learning goals. The students came up with ways to use technology as part of the learning in her class that simply amazed her, and made her see both the potential for these tools to expand learning and the potential for learning that comes when students partner in the design of the learning process. She has since become one of the

[73] Mehta et al 2012
[74] Groff 2008

strongest advocates in the school for how technology and learning partnerships with students can positively impact learning. As Dan says, she might not have opened the door without the requirement that students use the devices, but it was the power of learning alongside her students that really converted her.

We also heard examples of the organic spread of new pedagogies, where teachers within a school convinced each other to try out new approaches. In these cases, one teacher tries something new that fully engages students, and the excitement that is generated becomes a catalyst for other teachers in a school. Such was the case with Pauline Roberts' H2O Heroes project in Michigan and with Rhonda Hergott's Geodesic dome project in Canada. After seeing her students' engagement in the dome project, Rhonda said, "there is a huge teacher population that is so excited about September and doing this type of learning throughout the school as a whole." From Kindergarten through to 8th grade, every level of the school is embarking on new pedagogies. In Rhonda's school the teachers are strongly supported by school and district leadership. The principal saw what Rhonda was doing in the dome project and "was amazed by the learning that was happening." And so the principal told the story of the project to other teachers and to other leaders. As Rhonda explained:

> *The principal, LeeAnne Andriessen, was phenomenal in supporting me in taking this kind of risk. Some teachers would love to do this but were concerned about their EQAO (Education Quality Accountability Office) results – the standardised tests. Though I would argue that the learning in the 6 weeks of my project far exceeded what straight preparation for EQAO would achieve. The principal has provided lots of support and professional development on these models of learning. I would probably have tried it anyway, but it made it much easier with that support..*

The spread of new pedagogies happens organically when teachers recognise and internalise the power of new approaches to learning based on seeing them work with peers and students. However, as the above example shows, leadership and learning conditions within an education ecosystem can dramatically increase the chances for broader change.

As these examples suggest, the inherent change model by which new pedagogies spread is different because the change comes from all levels. The new learning partnerships between students and teachers, teachers' influence on their peers, and learning conditions shaped by leaders all converge to enable change. The difference that we see is that many changes start simultaneously and spread via multi-faceted pathways.

New Roles for Leaders and Conditions that Enable the New Pedagogies

Just as the roles of teachers and students are changing, the roles of school and education system leaders are changing as well. In the table below, we highlight some of the key roles of leaders in fostering and effectively implementing new pedagogies. These roles correspond with enabling conditions, which leaders influence and cultivate. When more of the conditions are present, new pedagogies stand a much higher chance of being implemented effectively and sustainably.

Table 5: New Leadership Roles and Enabling Conditions.

	Leadership Roles	Enabling Conditions
Culture	• Foster commitment to the moral imperative of change; build 'culture of yes', inviting change • Encourage risk: non-judgmental stance especially at the beginning; talk openly about mistakes • Continuously develop, define and communicate the new vision • Influence but do not control change • Practice collaboration: use the group to change the group • Model being a learner	• Readiness for change and openness to new possibilities • Shared commitment to moral imperative • Common and shared vision, even if not yet crystallised • Learning leadership culture with high expectations for all • Collaborative climate
Capacity	• Make new practices visible and transparent • Co-develop measures to support learning from the work • Provide and receive coaching, mentoring and professional learning • Find the means to provide ubiquity of technology • Be a partner in the learning, model the use of digital tools and devices, not necessarily as experts • Help to assess the impact of new practices on deep learning	• A plan for achieving the vision • Ways of measuring where things are now, learning from the work • Professional learning that builds pedagogical capacity and embeds the new concepts • Ubiquitous technology integrated with the whole new framework • Whole system framework

We have grouped these roles and conditions into the broad categories of 'culture' and 'capacity.' Both categories are needed for deep and sustained change within and across complex systems.[75] We begin here by describing how leaders can influence directional vision and culture, and then turn to innovation and capacity-building elements. One point to make at the outset: the change we are observing as new pedagogies take hold is neither top-down nor bottom up change. It is both and, it is also sideways. Ideas and energy flow vertically and laterally. Dissatisfaction mounts on the ground *and* at the top; pockets of new activity begin to stir; powerful new catalysts appear (such as digital access); new patterns of interaction break through; leaders at both the top and the bottom recognise and respond intuitively, independently, and then together; and the movement takes off. The role of leaders is to simultaneously help the organisation to 'let go' and 'rein in.'

[75] Fullan 2010; Barber *et al* 2010; Kay and Greenhill 2013

Learning Leadership Culture

Entertaining a directional vision for what is possible and where you want to go within the new realm of possibility is the first step on a successful path to change. Certain elements of school and system cultures can strongly support the spread of new pedagogies. But leaders in the new era must have a broad picture of the future and flesh it out with the group. Establishing a culture of learning leadership means recognising and embracing what it means for students and teachers to own the learning. One principal in Canada described what this is like:

> *I had to take two steps back so teachers and students could take three steps forward.*
>
> Andreas Meyer, WG Davis School Principal, Ontario, Canada

Another principal said:

> *I just tried to create an environment which is a culture of yes. It sounds like a small thing but it is not. It is huge.*
>
> Lawrence De Maeyer, Central Peel Secondary School, Ontario, Canada

Sometimes leaders help kick-start the process. Leadership becomes the expectation and the norm at every layer of the system, with students, teachers and leaders all leading their own learning. In such a culture, positive interpersonal relationships, encouragement and trust become even more essential. All stakeholders participate in developing and maintaining the social-emotional context of learning. They recognise and embrace the need for an empathetic, supportive environment where encouragement, shared leadership and non-punitive feedback are commonplace. Many of the teachers and school leaders we interviewed highlighted this aspect:

> *Leadership is also changing dramatically – leaders' roles with teachers are changing. Teachers are empowered. Teachers don't want one-size-fits-all in professional development; they want a voice. Everyone is a teacher-leader in my building. We are finding ways to pull the leadership out of everybody. It's a partnership, not a dictate.*
>
> Pauline Roberts, 5th and 6th Grade Teacher, Michigan, USA

This cascading model of learning through partnership extends through students, teachers and leaders – all learning with and from each other. When leaders model this, it is not leadership from the top, but leadership and learning from within. James Bond, the principal of Park Manor School in Ontario, Canada, described how his teachers developed the practice of learning together:

So whenever we did staff development [in the past], they were all over the map in terms of different knowledge and expertise with different high yield strategies. So a big question was how to have them be comfortable with learning and sharing from each other. Because I'm a big believer that within a school or a system, you have the expertise – if you can just connect the people and have them learn from each other. That was our big focus.

James Bond, Principal, Park Manor School, Ontario, Canada[76]

Cultures of learning leadership foster extraordinarily high expectations for teaching and learning. The Reinventing Schools Coalition's work in Alaska shows that when students have clearly defined expectations for learning achievement, and are then given responsibility for their own learning and support during the process, they achieve significantly more in less time.[77] When students set their own goals for learning, and teachers begin to see examples of what it is possible for students to achieve, it takes the lid off. No one is bound by the expectations defined by the formal curriculum for what should be achieved in a year's time.

Collaborative Cultures

Schools and systems that foster highly collaborative practices and purposefully build social capital are places where new pedagogies thrive. In particular, teacher isolation is the enemy here. But not all places begin with high levels of collaboration and, in such cases, one of the critical roles of leaders is to begin to demonstrate and model collaborative practices, taking a non-judgmental stance on how others engage, especially at the beginning. In the examples we saw of new pedagogies spreading effectively, teachers and school leaders were engaged in processes of continuous, collaborative evaluation of what worked and how to best achieve improvement.[78] These processes were deliberatively developed and the beginnings were often messy. But let us share what can happen using a vignette from the video of Park Manor:[79]

Four teachers sat around a table in their 'shared staff learning center' at Park Manor School in Ontario, Canada. The walls of the room were completely covered with individual 'student stickies' for every student in the school. Each student page had coloured markers showing that student's success and challenges by subject. Notes from different teachers were included behind each page. Any teacher could come into the room and have a clear and immediate visual picture of their students – and an ability to see if students who were struggling in their classrooms were having more success with other teachers. Teachers regularly shared the teaching strategies they were using with other teachers, discussing what worked to engage a kid, and what didn't.

[76] See more of the Park Manor story at Fullan 2014, Motion Leadership Film Series, www.michaelfullan.ca/ontario-park-manor/
[77] DeLorenzo *et al* 2008
[78] See more about how this kind of collaborative teacher inquiry works in Ontario at: www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/CBS_Collaborative_Teacher_Inquiry.pdf
[79] www.michaelfullan.ca/ontario-park-manor/

Through such collaboration, teachers develop common theories of practice, sharing their insights about strategies that impact individual students. A collaborative climate decreases teacher isolation and, at the same time, enables greater risk-taking. In schools and systems with collaborative climates, the risk of trying new approaches becomes shared. When leaders support such risk-taking and – more significantly – embrace the practice of talking openly about mistakes, collaborative climates establish the pattern of learning from mistakes.

The number one thing is having a director or leader at a school who gives you permission to try things and fail – that is most important. When a teacher tries something new, they are scared that if it doesn't work a parent will call and complain. That teacher needs to know that they will have someone at their back.

Kelli Etheredge, 10th Grade Teacher, St. Paul's School, Alabama, USA

Just as students build grit and perseverance through struggling with hard challenges, so too do teachers and leaders. While tremendously exciting, beginning new pedagogies is still a hard challenge. Partnerships, feedback, learning while doing – all these elements apply at the school and system level, and are all supported by collaborative cultures. Finally, it is critical to note that such collaboration is focused, specific, and purposeful. It zeroes on the actual new pedagogy that needs to be created.

These positive developments are all the more crucial in the face of recent problematic developments in the U.S. toward greater instructional micro-management. The role of school leaders is not to try and influence instruction in a direct one-to-one fashion but rather to enable and help develop focused collaborative cultures-use the group to change the group, as we say.

Capturing the Vision and Building Shared Commitment

One of the most important roles leaders can play in spreading the contagion of new pedagogies is to continuously develop, define and communicate the new vision. This is not an individual or a small group of leaders making up the story and telling it to others; it is non-stop partnering with teachers, students and community stakeholders to build a common vision, collaborating to internalise the concepts, and identifying shared stories and examples that realise the vision as it becomes a reality.

Sharing stories and examples can go beyond the boundaries of one school or system. Some schools and systems are developing online platforms for broader sharing of such examples. As described above, High Tech High uses large public exhibitions of student work. These broaden awareness of what it is possible for students to achieve.

In both culture and capacity building, an essential part of a leader's role is to gauge a school or learning community's readiness for change. Every classroom, school and education system is at a different stage of development and faces its own unique context.[80] For a school that has challenges with student violence, the appropriate starting point might not be a focus on risk-taking, but rather on the development of trust, student voice and shared responsibility. For systems with low levels of pedagogical capacity, developing teachers is likely to be the first step in the process. The ideas we present here are not intended as a universal prescription, but as a framework from which to develop ideas. It is a framework that leaders and learning communities can draw from in the course of change efforts. As we describe below, ongoing self-assessment is the foundation of effective implementation. Throughout, leaders in the new mode must have a broad vision, openly inviting others to explore new possibilities. Such leaders are non-judgmental: they *practice* that it is okay to make mistakes. They like teachers to lead the way. And as experience accumulates, they help the group to assess what is working in order to get to the next phase.

Building Capacities

Three types of capacity support the new pedagogies: 1) the nature and use of new measures; 2) ongoing development of the new pedagogies; and 3) the provision of ubiquitous technology.

Measurement and Learning from the Work

In the previous section on new pedagogies in practice, we discussed how teachers are developing new ways to measure deep learning that are specific to particular deep learning tasks. And we highlighted the critical need for new systems of measures. Indeed, *new measures should be seen as essential enabling conditions for the effective implementation of the new pedagogies*. Here we turn to the system-level issues around measures that are the domain of school and system leaders. We need new measures not only of students' deep learning outcomes, but also of pedagogical capacity and of culture and system capacity. These measures would include the evolving roles of teachers and leaders, the cultural elements described above, the state of educators' professional learning, and the overall capacities, resources and alignment of the system (region or province, state and/or country). Changing the content of what is measured and how it is measured in schools and systems can firmly support the expansion and sustainability of new pedagogies, but such measures must be carefully constructed and respond to local contexts.[81]

"New measures should be seen as essential enabling conditions for the effective implementation of the new pedagogies"

[80] Mourshed et al 2010; Day et al 2011
[81] Fullan and Langworthy 2013

As we have argued above and elsewhere, measurement is all too often used solely for accountability purposes rather than as a tool to support learning, transparency and system growth.[82] Too much focus on accountability stifles innovation. These issues are front and center for almost all education system leaders today.[83] John Hattie has written that 'visible learning' means teachers and schools know the impact of their teaching strategies on students.'[84] Schools and systems need the same insight into what is working. This is what we call 'learning from the work', and it is extremely challenging to do without clear ways to measure where you are in relation to your whole system vision and its goals. The development and use of measures also gives participants a shared common language, which in turns builds meaning, legitimacy and moral momentum for the change.

The content of the measures used in accountability systems needs to be updated to align with new pedagogies' practices and deep learning goals. As Tan Chen Kee, principal of Crescent Girls School in Singapore, said to us, "assessment really needs to catch up – otherwise it is a huge challenge for the teachers." Others expressed similar sentiments:

> *I think that as far as high stakes testing goes, the EQAO (Education Quality Accountability Office, Ontario's standards assessment) is excellent, but I think that it is having troubling keeping pace with the new realities of how we approach teaching and learning.*
>
> Shaun Moynihan, Superintendent of Curriculum Instruction, Peel School District, Ontario, Canada

> *Teachers are more occupied preparing for national exams than doing what they think is best for students. It is not easy to innovative because results may not hit national exams immediately.*
>
> Luis Fernandes, Director, Freixo School Cluster, Portugal

Education system leaders and the broader public are slowly becoming aware that current measurement systems are barriers to change, but solutions still appear to be a long way off. The new Common Core State Standards (CCSS) Assessments in the US signal some promise of replacing a purely content knowledge focus (especially in relation to the status quo), but many realise the need for additional measures that can better support deep learning in practice.[85]

[82] Fullan 2011
[83] Mulgan *et al* 2013
[84] Hattie 2012
[85] Conley and Darling-Hammond 2013

Developing new measures that are aligned to the visions and goals of new pedagogies and deep learning does not have to be a Herculean task, nor does it have to be done alone. In the previous section, we outlined broad characteristics that could define a system of new measures, characteristics that are feasible to implement. The global, multi-stakeholder partnership, *New Pedagogies for Deep Learning*, that we are part of, is embarking on this task as part of its efforts to mobilise whole systems towards deep learning. In the work of this partnership, we are collaborating to develop new measures involving the collection and analysis of deep learning tasks and students' work; measures of student engagement, attitudes and dispositions; measures of learning conditions such as teachers' perceptions and practices; and schools' and systems' cultures and capacities. This endeavour is based on the fundamental premise that measurement should be used primarily to *support learning*, and should therefore assess both inputs to, and outcomes from, the learning process. Prior research clearly shows that the nature and quality of learning activities and learning environments relate to learning outcomes.[86] Not every system is at the stage where implementing wholly new measures and accountability systems is feasible or desirable. We see a continuum of system transformation that begins with existing measures, moves to dual measures, and ultimately reaches a stage of measurement that fully embeds and supports new pedagogies and deep learning outcomes.

New Pedagogical Capacities

New measures alone, however, will not change systems. New measures must be combined with real changes in the design and practice of teaching. The quality and nature of professional learning among teachers and leaders is an essential element for effective implementation. There are two essential components to professional learning: *day-to-day learning*, and the policies and strategies that relate to the *teaching profession*. The quickest way to consider day-to-day learning is to ask the question, "which of the following three strategies contributes most to teacher learning: formal, episodic professional development programs (PD), teacher appraisal or collaborative cultures?" As obvious an answer as PD may seem, it is not by itself a robust learning strategy. One or more PD sessions won't bring implementation, even if all staff attend. PD is only an input. It is what happens between PD sessions that counts. Teacher appraisal is even weaker. How could two or three (at best) evaluation sessions a year make a difference? This is a point that Murphy, Hallinger and Heck convincingly make in their research article *The Case of the Missing Clothes*[87], and which Michael also documents from a leader's perspective in the new book *The Principal*.[88] As for collaborative cultures, we have 40 years of research showing that continuous, focused collaboration produces learning school-wide. Again, this makes sense. If teachers are learning together day in and day out (learning is the work), it makes the difference. Our conclusion is that developing learning cultures is the primary task, with professional development and appraisal as enablers, not drivers. Professional learning should be designed as a holistic, ongoing formative feedback cycle with continuous collaboration at its center.

[86] Dumont et al 2010; ITL Research 2011
[87] Murphy, Hallenger and Heck 2013
[88] Fullan 2014a

How leaders approach, engage and partner in professional learning is critical. In the cases of effective professional learning that we have seen, leaders truly do partner in the learning – with teachers, students, peer leaders and the broader stakeholder community. And they foster particular kinds of professional learning, most often involving 1) collaborative, social learning, 2) relevance to the local context, and 3) analysis of impact in relation to desired student learning outcomes (e.g., professional learning is structured by clear learning goals and success criteria). Professional learning is practice-based with a focus on application rather than accountability. If it sounds a lot like how the new pedagogies work to support deep learning, that's because it is. This work also builds teachers' pedagogical capacity in terms of expanding their repertoires of teaching strategies and developing an inquiry-based approach to teaching where analysis of student work and progress is used to modify teaching strategies. It supports teachers in their emerging roles as described in Chapter 2. All of this represents a fundamental shift in the teaching profession that Andy Hargreaves and Michael mapped out in their book, *Professional Capital*.[89]

Countries such as Singapore, Finland and Canada have developed their teaching professions over decades in the broad directions we are talking about, and so are in a better position to develop the further capacities essential for new pedagogies. In the US at least, this is not the direction of current policy, which centers on appraisal. We have made the case that this will not build a profession; in fact it will weaken it. A similar case is made more comprehensively by Jal Mehta.[90] He argues that an effective profession depends on: i) who is drawn to it; ii) whether it develops a cumulative knowledge base; iii) how it ensures that the knowledge is used consistently; and iv) how these three are aligned with an overarching accountability system. He concludes that the task is to move from a 'bureaucracy to a profession' by remaking the sector so that it attracts, generates, supports and propels teachers who are quintessentially pedagogical professionals, i.e., experts in the process of learning.

Developing pedagogical professionals is not easy. Colleges of education would be a good place to start. Kirsti Lonka, who is a professor and Vice Dean at the University of Helsinki and who studies and develops teachers' university training in Finland, said in our interview:

> *Teacher education – it is very traditional. Teacher training in universities should resemble the kind of project-based learning and working environment that people have outside of schools. Medical students are trained in hospitals. Teachers - they don't see how people work today… This is a big problem - the training itself is very didactic. The professors for teachers do lecturing.*
>
> Kirsti Lonka, Professor and Vice Dean, University of Helsinki, Finland

Teacher colleges need to begin to model deep learning competencies in teacher training experiences.

[89] Hargreaves and Fullan 2012
[90] Mehta 2013b

We have seen and been involved in professional learning that puts into practice the core ideas of the new pedagogies and deep learning. One professional learning program that embodies the new pedagogies' concepts, one in which Maria has been significantly involved, is called 21st Century Learning Design. This professional learning program emerged from the Innovative Teaching and Learning Research (ITL Research) project sponsored by Microsoft's Partners in Learning, and was developed in collaboration with SRI International. 21st Century Learning Design, or '21CLD,' provides small groups of teachers with a set of rubrics for analysing learning activities (which range from traditional lesson plans to the kinds of deep learning tasks described above), and a corresponding set of rubrics for analysing the student work that results. Each rubric provides an explicit definition and concrete indicators of progress on a specific competency, such as problem-solving, knowledge construction or self-regulation. Teachers first work together in groups using the rubrics to code example learning activities and student work samples. Each group then uses the rubrics to analyse and code some of their own learning activities, and then collaboratively redesign those learning activities to remake them into powerful deep learning tasks. Teachers then test out the newly-designed learning tasks with their students, and return to share the impact with the group. The process then becomes a cycle of redesigning learning tasks through ongoing collaboration, and collectively analysing the impact on students' learning. 21CLD thus provides teachers with a structured path for implementing deep learning tasks.[91]

The 21CLD rubrics and program give teachers a bridge between the theory and practice of new pedagogies. The program is expanding rapidly internationally – from Finland and Australia to Senegal and Brunei. In one school in Singapore that has adopted 21CLD, the principal explained:

> *Teachers are mostly concerned about what is good for the kids. Our teachers saw the need to get kids "work-ready". Not just ready for next stage of schooling. Teachers believed in the new competencies and deep learning, not just to pass exams. But the tyranny of the urgent [in schools] always takes over. They all agree with the rationale and the need, so they needed the support and the time to take these steps. That is where 21CLD was a very powerful tool – it gave them an explicit way to redesign their learning activities; and it was a simple enough instrument to use.*
>
> Tan Chen Kee, Principal, Crescent Girls School, Singapore

Other professional learning approaches and programs, such as lesson study, peer coaching, teacher meet-ups and professional learning communities, can all foster the kind of collaboration and learning partnerships needed to support new pedagogies. The key is to orient the content and structure of such programs to the core components of new pedagogies and on deep learning outcomes. Action research and inquiry-based approaches in particular can be great models for this kind of professional learning.

[91] See how 21CLD works in action at: http://itlresearch.com/itl-leap21

Technology Ubiquity

The third key capacity element needed for new pedagogies concerns how to use technology in the service of deep learning from a school and system perspective. *Effective implementation* of digital tools and resources across whole systems involves not just using them as part of learning partnerships and deep learning tasks. School and system leaders seeking to implement new pedagogies successfully develop the enabling conditions described above alongside investments in digital access. Without the broader vision and capacities, investment in devices for everyone rarely pays off in terms of learning outcomes. However, we have seen successful integration of technology in publicly-funded schools and education systems, and we share here some examples of what happens when visions and capacity-building come before purchases.

When students each have their own devices, full access to digital learning applications and resources, and the freedom to explore and use these elements as part of well-structured deep learning tasks, learning can be dramatically expanded. For maximum impact on student learning, technology integration needs its own set of 'enablers'. Systems cannot simply buy a device for every student and expect new pedagogies and deep learning to ignite. Technology in schools changes the conditions, but does not by itself shift practices. Effective technology integration requires many elements: digital resources that align with learning and curriculum goals; technology training for staff as well as professional learning focused on building pedagogical capacity; high speed Internet access; integrated assessment and progress monitoring systems; reporting mechanisms to allow frequent learning from the work; communications with parents and stakeholders; infrastructure that includes security and privacy protections; support and maintenance for the equipment; and a digital citizenship policy. The costs of this will be discussed in the next section, but we will say here that when a plan is done well, the return on investment can be immense.

The best examples of technology integrated with other elements of new pedagogies come when whole schools and systems – rather than individual teachers or classrooms – undertake the integration. The Fontan schools in the Americas and Spain have done this by using technology as a tool to support learning partnerships:

> *Technology helps the scope of the learning. I am not talking about virtual school. Technology is how our method works, but it wouldn't work without the personal relationships [between educators and peers], figuring out who each student is individually. We use technology to personalise WITH the student.*
>
> Erika Twani, CEO, Learning 1 to 1 Foundation

In schools based on the Fontan Relational Education model, every student has a digital device, through which they access curricular materials and carry out deep learning tasks individually or with peer groups. Through the system's online Qino Platform, students, parents and educators access learning materials, collaborate, communicate and manage students' learning plans and projects – anytime, from anywhere with internet access.

For school and system leaders thinking about ubiquitous access, some of the biggest questions involve personal devices, content filtering and parental acceptance. The 'bring your own device' or BYOD movement is taking off in many schools and systems, allowing students who own their own laptops, smartphones or tablets to bring them into schools and make them part of the learning experience. These programs of course face the significant challenge of student equity, of all students having the same or similar levels of access to digital learning resources. This challenge is likely more of a problem in societies and schools that have high levels of economic inequality among their student populations, and in such contexts, the implementation of a BYOD policy should be very carefully considered to ensure it does not exacerbate the challenges that poorer students face. Some systems beginning these programs are addressing this challenge by providing school or system-funded devices to all children who do not already own a device.

In our discussions with leaders who had implemented BYOD, it became clear that going down this path was not just a policy and resource decision but also a powerful cultural change statement. In the Peel school district in Ontario, Canada, when the leadership team announced the new BYOD policy at a meeting of school principals and teachers, there was a standing ovation from the audience.

The emotion was palpable. It goes back to the co-learning stance – that is what you need. You need a sense of freedom, a sense of optimism, and you need a sense that experimentation is OK and that is how we learn.

Shaun Moynihan, Superintendent of Curriculum Instruction, Peel School District, Ontario

Yet with freedom comes responsibility. When students gain access to tools that give them the ability to access information and to communicate their ideas and opinions globally, that access must be balanced with the development of ethics for responsible use. Alongside empowering students with devices, schools need to develop programs for digital citizenship that provide clear guidelines for appropriate use of the technology.[92] Teachers and leaders have said that trying to limit or control access is ineffective and that digital citizenship is more realistic:

We talk with kids who are using tech inappropriately and guide them to think about that more constructively. To try to block it is like trying to stick a finger in a dam.

Pauline Roberts, 5th and 6th Grade Teacher, Michigan, USA

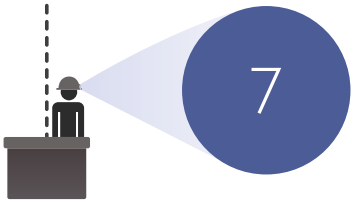
In a heavily filtered school environment, the opportunity to cultivate students' appropriate use is effectively denied. A policy that opens school networks, paired with instruction on appropriate use, identity protection and safety, would far better enable students to become more conscientious consumers (and producers) of Web 2.0 content.

Jennifer Jensen et al, 2011; Peel School District Report

[92] Jensen *et al* 2011

Finally, an essential element of successful initiatives is the inclusion of parents. Without parental consent, understanding and explicit support, digital access programs do not reach their full potential. Parents need to understand how the technology is being used to improve learning. Gaining this consent and support is one of the new roles of school and system leaders. Indeed, developing public support for the new pedagogies model as a whole should be part and parcel of technology initiatives. One example we saw was a survey of parents in Peel School District, to determine parents' priorities for the program – which were more professional learning for teachers, equitable access, Wi-Fi and more parental communications. In Pauline Roberts' school in Michigan, they host monthly parent technology nights, where parents are introduced to applications such as Twitter and are shown how it can be used for learning purposes. Such programs involve parents in the learning process and engage them as stakeholders and partners in these new learning experiences.

The new change leadership that we have been describing in this chapter represents a huge challenge, but signs indicate that it is as attractive to people as it is daunting. The traditional school is being broken open and new forces for learning are almost spontaneously erupting. And we find more and more leaders—students, teachers and administrators alike – who recognise and embrace the new possibilities. Right now, at the early stages of these dynamic developments there is a great deal of ambiguity and uncertainty as to where things might and should go. This is normal at times of upheaval. The good news is that things are converging to create the distinct possibility that a critical mass of radically new learning practices are emerging. There is a good chance that these developments could turn out to be the new norm one day soon. Leadership at all levels has never been more critical. The best news is that leaders who want to make a difference now have an opportunity to have a huge impact.



7 The New System Economics

It's just a matter of time until it's one device per child. It's madness that we're not there already. It's just a change in the resource model… It increases learning, but only if it's done right. Technology without the right conditions is a waste of money.

Dan Buckley, Deputy Head, Saltash.net Community School, Cornwall, England

Much of this report has focused on providing greater clarity, precision and insight into what new pedagogies are, how they find deep learning, and how schools can move towards them. In this chapter, we turn to education policy and system issues concerning overall outcomes and costs of the new model. We will see that when students and teachers partner and begin redesigning learning practices, and use technology in support of the new practices, learning outcomes can dramatically improve. We will also pursue a preliminary exploration into the economics of the new pedagogies model, making the case that the new model can deliver dramatically more relevant learning outcomes, and can do so within the economic realities of education systems today. Our explicit intent is to provide education leaders and policymakers not only with a convincing argument for the economic viability of the new pedagogies model, but also with the early data and proof points to back it up.

The economics of the new pedagogies – both in terms of costs and outcomes – is not an exact science. However, in this section, we marshal compelling evidence to lay out the case that *by investing resources in the capacities and policies needed for the effective implementation of new pedagogies, there is a strong potential for education systems to achieve twice the learning for the same price or less*, relative to existing systems. Specific and targeted capacity-building efforts are needed to develop teachers' pedagogical capacities and to provide pervasive digital resources to students. And whole-system realignment of accountability and assessment measures are also needed. By committing to these interdependent changes, our education models can begin to re-engage students and teachers in the excitement of learning, and our schools can fulfill their missions to prepare students for life and work in the new era.

The New Learning Outcomes

First, let us make the case that new pedagogies can deliver significantly higher learning outcomes. The argument begins with evidence provided from meta-analyses of 'high yield' strategies that have the highest impacts on learning, as discussed in Chapter 2. In both John Hattie's meta-analysis and the Education Endowment Foundation Teaching and Learning toolkit[93], the strategies at the core of new pedagogies have been shown to have high effect sizes and major impacts on learning outcomes:

Table 6: Average Effect Size of New Pedagogies

Teaching and Learning Strategy	Hattie's Effect Size on Learning	EEF Toolkit Average Impact
Providing formative evaluation	.90	Not included
Feedback	.75	+8 months
Meta-cognitive strategies (Self-regulation)	.69	+8 months
Peer tutoring	.55	+ 6 months
Average Effect Size/Average Impact	**.72**	**+7.3 months**

So the "average impact" of the new pedagogies' strategies in terms of a student's additional months of progress beyond the average[94], is over seven months.[95] Such high-yield teaching strategies result in significantly more learning per year for the same investment. Over the course of a student's schooling, the cumulative impact could be quite dramatic.

As we have articulated throughout this paper, new pedagogies are not as simple as using any one teaching strategy in isolation. Rather, they ask teachers and students to take a new partnership approach to teaching and learning, with teachers working alongside students to define and carry out relevant deep learning tasks that create and use new knowledge in the world. Throughout the process, teachers and students continuously monitor the learning process, analysing what moves the learning forward most effectively, then refining or changing strategies to find what works best. When the teaching strategies described above are fully enabled and accelerated by technology that provides 1) ubiquitous access to content knowledge; 2) the tools and resources for creating and using new knowledge; and 3) insight into the learning process and student progress, the potential for dramatic improvements in outcomes grows even stronger. Most schools, systems and educational technology providers are at the very early stages of learning how to effectively implement technology to improve learning outcomes. Technology ubiquity, where every student has a device (called 1 to 1), is still a rarity throughout most of the world.

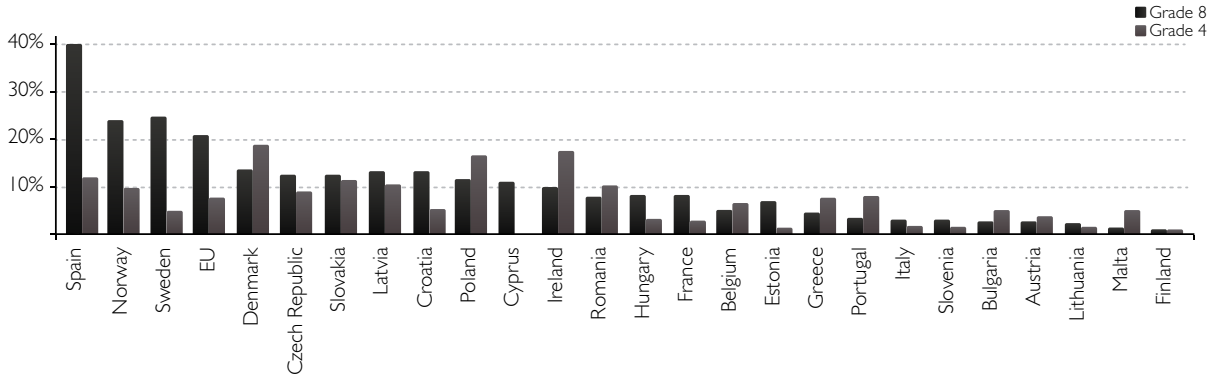
[93] http://educationendowmentfoundation.org.uk/toolkit/

[94] The average effect size across all 150 teaching strategies researched in Hattie's work was .40 and, unsurprisingly, the average annual effect size on student learning is .40 for a student's year of progress in learning. So, on average, a student's learning doubles roughly every 2.5 years. There is independent agreement of the .40 as a reasonable estimate of a year's change. The New Pedagogies moves that effect size to .72, almost doubling the amount of learning taking place in a year's time

[95] These measures are presented in terms of the strategies' impact on traditional learning outcomes: content knowledge mastery and basic skills.

The chart below from the European SchoolNet[96] shows the percentage of grade 4 and 8 students in 1 to 1 classes in European Union countries in 2011-12. Only Spain, Norway and Sweden reach close to 25% of students in grade 8 having 1 to 1 (though we have no information on the quality of implementation).

Figure 13: Low Rates of Pervasive Technology in Most Countries



In places where there has been effective implementation of new pedagogies through combining all the core components and developing the right conditions, the system-level results are amazing. The Fontan schools in Latin America and Spain (10,000 students), the High Tech High system in California (5,000 students), and the Mooresville Graded School District in North Carolina (5,600 students) all show that these models can be implemented, can achieve significantly increased learning outcomes, and can do so at normal or below average resource levels. The outcomes of the High Tech High (HTH) system[97] speak for themselves:

- 98% of HTH's graduates have gone on to college (as compared with 68% in the US population at large), with approximately 75% attending four-year programs such as Johns Hopkins University, Massachusetts Institute of Technology and Stanford University.
- Over 30% of HTH alumni enter math or science fields (versus a national rate of 17%).
- HTH's African-American students outperform district and state-wide peers by a wide margin on test scores; the percentage who take chemistry, physics and advanced math (100%); and college entry (100%).
- Through the Academic Internship Program, HTH students have completed more than 1000 internships in over 300 community businesses and agencies.

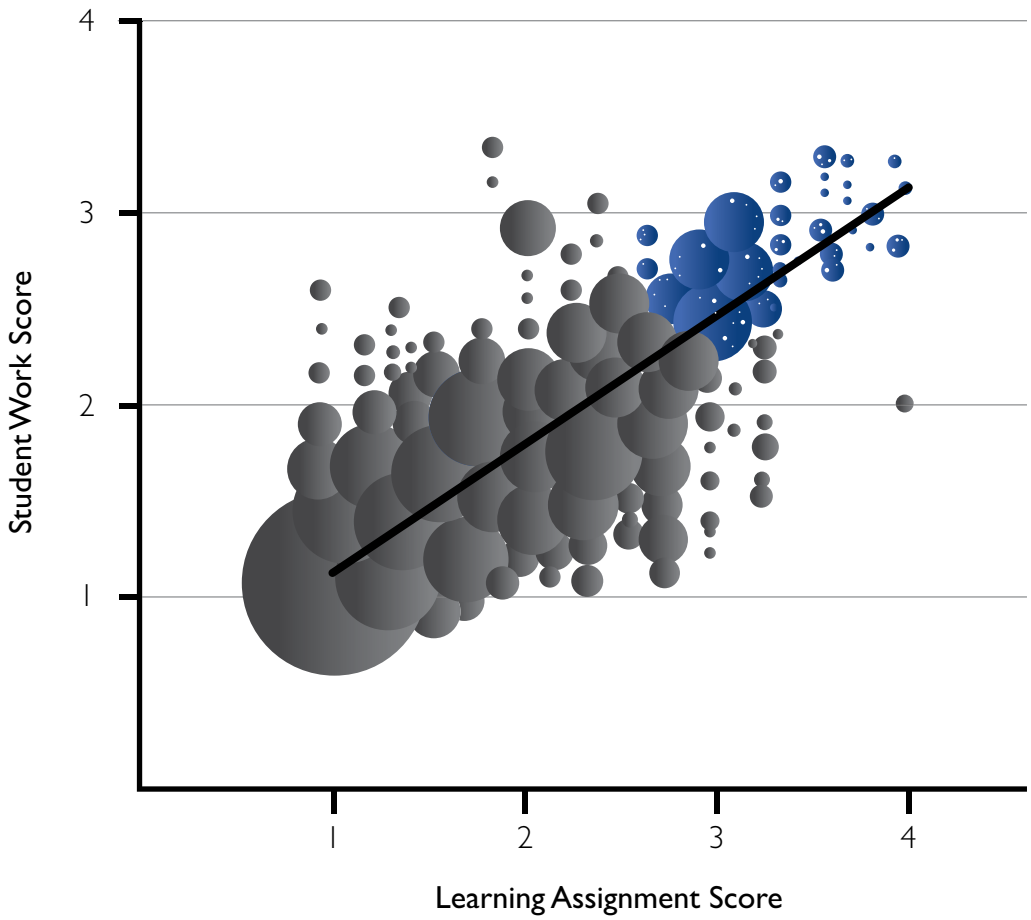
[96] European SchoolNet 2013
[97] For more on the High Tech High approach, see: www.youtube.com/watch?v=qSzkwceFKHc

HTH achieves this with a significant population of students from minority groups and at cost of roughly $6,000 a year per student, significantly below the US national average of $11,831 per public school student.[98] Public schools in Colombia that adopted the Fontan Relational Education model moved from poor or medium to superior performance on national examinations across all subjects in two to three years. The national school dropout rate in Colombia is 30%; in Fontan schools it is 0.7%. They achieved this while accelerating students' completion of required curriculum by 10% and spending the same per pupil as other public schools. Such accelerated learning allows educators to collaborate with students, integrating aspirations and interests with learning goals, rather than being constrained to standardised curriculum delivery. The Mooresville Graded School District in North Carolina, despite ranking among the lowest funding levels per pupil in the state, earned the third highest graduation rates and second best test scores – improving composite achievement scores from 73% in 2007-2008 to 89% in 2011-2012. What is perhaps most exciting in Mooresville is that the strongest achievement gains were made by disadvantaged students, such as students with special needs, English language learners and minorities. In each of these three systems, every student has their own digital device, and the focus is on learning through new pedagogies first and then on the strategic use of technology to build learning partnerships, to empower students as they do deep learning tasks, and to accelerate the learning. Park Manor in Elmira, Ontario – a regular public school in a large system – experienced a huge increase in top writing proficiency from 42% to 83% by integrating pedagogy, technology and change knowledge.

And the picture is still not complete. The argument for significantly improved outcomes relies not only on improvements in traditional outcome measures. As discussed previously, the effect of new pedagogies on deep learning is not yet consistently measured in the systems described above. We do not yet know the effect of new pedagogies on the deep learning competencies of creating and using new knowledge in the world. Some early research on deep learning provides initial evidence that, when learning is explicitly designed to foster deep learning, students do develop these competencies. The ITL Research[99] project is one of the few that has systematically studied and measured students' development of '21st century skills'. Across seven countries in 2010-2011, ITL research teams gathered teachers' learning activities and the student work that resulted. The teams then coded these using rubrics that explicitly defined levels of skills such as problem-solving, knowledge construction and self-regulation, assigning higher scores to activities and student work that called for or demonstrated higher skills. The chart below shows the results from the analysis of 967 learning activities and 3,367 examples of student work that were coded.

[98] New York Times 2013; Gallup 2013c
[99] ITL Research 2011

Figure 14: Learning Activity Scores Predict Student Work Scores



Source: ITL Research, 2011, based on Analysis by SRI International

The clear positive correlation between learning activity scores and student work scores shows that, when learning tasks are designed in ways that intentionally develop skills (a 3 or a 4 on the learning activity score), student work demonstrates students' development of these skills. However, as we see, there are very few examples of activities and work that achieve a 3 or a 4. The ITL report summarises:

> *The findings are clear:* ***The characteristics of an assigned learning activity strongly predict the skills demonstrated in student work****. We found a strong association between learning activity scores and corresponding student work scores. This suggests that students are much more likely to build and exhibit 21st century skills if the learning activities in which they engage as part of a class ask them to demonstrate those skills.*

Let us be clear that we are not arguing for the teaching and learning of 'generic' deep learning skills i.e. teaching 'collaboration' or 'knowledge construction' outside a content domain. We are saying that when the learning process is designed in a way that requires content mastery in order for students to create and use new knowledge, both students' content knowledge *and* their deep learning skills are developed. You don't develop collaboration skills by talking about collaboration in the abstract; you develop them by collaborating on issues and problems of substance that require content knowledge. Hattie's research shows that developing deep learning skills without grounding them in real content will not work. As more measures of deep learning are developed and implemented, we will have more evidence on how the combination of skills and content mastery impact outcomes for both.

So the new pedagogies have the potential to offer a powerful new education model that can deliver dramatic new outcomes. But if these pedagogies are implemented ineffectively, their effect will be blunted. In Chapter 5 we described effective versus vs. ineffective versions of new pedagogies, and in Chapter 6 we discussed the cultural and capacity conditions that enable the effective implementation of new pedagogies across schools and systems. Here we turn to the important question of the investments needed.

The Cost Balance of Ubiquitous Technology

The actual cost of providing technology ubiquity for every teacher and every student in a system is coming down every day as price points for devices decrease, more high quality learning resources become available online, and as teachers and students naturally become more digitally sophisticated in their everyday lives. Technology itself will ultimately not be a major expense. We agree with Mark Edwards, superintendent of the Mooresville district who has written, "…funding digital conversion is mostly about prioritising and repurposing, not about finding new or more monies."[100] Our use of the term "ubiquitous technology" means 1 to 1 – an internet-connected device for every child both inside and outside of school. There are several important sub-categories of costs underlying ubiquitous technology: devices, infrastructure, internet access, content and learning applications, student information systems, technology training (separate from the overall professional learning for pedagogical capacity) and technology maintenance and support. Our argument claims the potential for 'twice the learning for the same price or less." Above, we have outlined how new pedagogies could potentially deliver twice the learning. So the question now becomes whether the specific cost outlays for providing ubiquitous technology are feasible, given the existing fiscal realities of education systems.

[100] Edwards 2013

The cost model we present here is based on the newest costs for technology in the United States. The model's costs, assumptions and ratios will vary by country and region, but the overall model can provide a useful tool for policymakers as they consider the big picture of these investments. We developed the cost and savings model based on analysis of current device costs as well as through discussions with technology providers and school district technology managers.[101] Shown below on the left side of the table are the basic categories of costs for providing technology ubiquity for every student, using per student per year cost estimates. It includes the infrastructure and supports needed to make the technology function well for learning (but not the other costs associated with effective implementation of the whole new pedagogies model described above). On the right side of the table are major categories of cost savings and potential savings. Below the table is a description of each of the cost and savings categories, explaining the assumptions behind each amount presented.

Table 7: Financial Model for Cost Balance of Providing Ubiquitous Technology

Cost categories per student per year	Amount in USD
Device	85.00
Infrastructure	25.00
Access	30.00
Content and Learning Applications	40.00
Maintenance and Support	35.00
Technology Training	5.00
Total Cost	**$220.00**

Cost savings and offsets per student per year	Amount in USD
BYOD/Parent Contribution	50.00
Reduced printing	50.00
Facilities repurposing	30.00
Savings from online PD	10.00
Reduced travel/postage/ phone	10.00
Reduced textbooks	70.00
Total Savings/Offsets	**$220.00**

This model shows that the costs of providing ubiquitous technology have dramatically declined, and the offsets and savings that occur when technology is implemented strategically can cover these overall costs. Using the latest pricing and assumptions, total costs are much less than one might have seen even two or three years ago. The table shows that education systems can implement pervasive digital tools without spending more. And in the bargain, as we have seen, get far greater learning results.

[101] We would like to thank Mark Keating, the CIO of Peel District School Board in Ontario, Canada, and Rob Neu, Superintendent, Federal Way School District, Washington, USA for their reviews and validation of the estimates provided here.

Cost Categories

- Device: the purchase of the technology device is the largest cost category. This estimate of $85 per device assumes a three-year lifecycle, and is based on the current pricing for educational tablets at roughly $250, though similar costs are possible for student laptops. We are beginning to see tablets as low as $200. This amount covers purchase or leasing of devices, which has recently becoming an option (part of the overall shift toward technology as a service cost rather than a capital expenditure). The good news is that when purchased or leased in large quantities at the district, state or country level, device costs can be reduced further, and there is a high likelihood that prices will continue to decline.

- Technology Infrastructure: To make devices optimally useful learning tools, they must be integrated at the school and system level with collaboration and productivity platforms, learning management systems, student information systems, content management systems, student portfolios, and privacy and security management. This infrastructure has been traditionally managed through onsite servers that require significant capital expenditures and IT staff. Today, more of these costs can be moved to cloud-based services which are more affordable to implement, manage, support and integrate into classrooms. Infrastructure costs also become operational expenditures rather than capital ones. A blended approach of on-premises and cloud may be a preferred option in certain parts of the world, given policies that require local storage of student data for privacy reasons.

- Access: This cost category includes high speed internet as well as Wi-Fi within schools. Both of these are necessary 'plumbing' to enable the full potential of technology to deliver high quality learning resources and to save costs in other areas. As with devices, when access rates are negotiated on a large scale, educational systems can reduce costs for this category further. Rates for access will vary considerably by country and location, and this is a cost category where governments are providing programs to reduce costs (see the eRate program in the US). Home access for students is not covered here. However, enabling student access at home should be a key policy driver at a broader government level to ensure equitable access to learning for all 24/7. It should also be noted that the cost of providing access is higher if it is the first time access is implemented and additional wiring, etc. is needed.

- Content and Applications: One of the most valuable aspects of ubiquitous technology from a learning perspective is the access it provides to almost limitless learning resources and tools, from curated materials specific to subject domains, to creative and collaborative tools used in modern organisations, to games, personalised content and simulations that can adapt to individual learners' interests and levels of progress. These resources are available through open educational resources that are perceived by teacher and students as being on par in quality with paid resources.[102] High quality and curricular-aligned materials are in many cases well worth the investment, but such investments will be challenged by crowd-sourcing of digital content and costs further reduced by concurrent access licensing. Every school and system will need to determine the level at which they wish to invest in these types of materials, but a strategy for including them should be part of the overall costs.

[102] Bliss *et al* 2013

- Maintenance and Support. This is not a category where underinvestment is a good idea. Many technology implementations in education have failed because of lack of adequate support to keep devices, infrastructure, access and content flowing smoothly. However, there are ways to optimise the investment, such as having student tech teams that help maintain and support devices and systems, which has proved to be an incredible source of strengthening and expanding device support, especially if students are well organised and trained by professional staff and have online support resources.

- Staff Technology Training. We separate the cost of technology training from the broader professional learning needed to transform teaching and learning described above. The costs in the table above represent purely technical training. Such training is necessary, and is increasingly provided as part of purchases. Additionally, teachers are increasingly digitally sophisticated, and need only ideas, examples and short training that can be provided online. Again, this is not an area to under-invest, but the total cost of this type of training is falling significantly.

For each of the cost categories described above, district, state or province, and national government subsidies are becoming available to help individual schools manage costs.

Cost Offsets and Savings

- **BYOD** (Bring Your Own Device) **or Parent Contributions**. Education systems are making technology ubiquity affordable by, for example, allowing students to bring their own devices into the learning process, offering online access to learning resources, and asking parents to contribute. The issue of equity – ensuring all students have the same or equivalent levels of access is paramount in these discussions. Having sliding-scale contributions aligned with family incomes is one way to address this, as was implemented nationally in Portugal through the Magellan Initiative. Providing fully equipped devices for those students who do not have their own is another way systems address the equity issue. Both ways can dramatically reduce the cost of the device to education systems, and also increase the level of psychological investment in programs by families. However, in our model, even if BYOD is not used, the overall cost per student is roughly 220 USD. Other means of collecting funds might be via property tax levies in the form of a Technology Levy.

- **Reduced Printing**. In most schools printing, copying and the use of paper-based materials is a considerable expense. A per child per year cost of 50 USD is in fact a conservative estimate, considering that in many schools students receive 3 to 5 new papers each day, as well as communications to parents, and copier maintenance. Technology ubiquity allows such costs to be dramatically reduced if not altogether eliminated, and allows communication levels to all stakeholders to significantly increase.

- **Facilities Repurposing**. Many schools already have computer labs or areas devoted to seating large numbers of PCs. When ubiquitous technology is implemented and every student has a portable device, these areas can be repurposed into spaces such as classrooms or meeting rooms. Depending on whether a school has additional space needs, this can save significant capital expense. However, there is room for debate on whether new pedagogies benefit from different types of facilities with different space arrangements than traditional classroom-based schools. Major changes to facilities design would of course incur additional expense. (In our view new facilities are nice, but not a requirement for effective implementation of the new pedagogies model.)

- **Savings from Online Professional Learning**. Traditional professional development often involves workshops, which incur fees for every teacher as well as the time and travel expenses of attending. As described in Chapter 6, the type of embedded professional learning needed for new pedagogies takes place continuously within the school, and can be supported by online exemplars and collaboration, potentially reducing the overall cost of professional learning. In many countries, the cost of teacher travel to professional development is considerable, so school-based collaboration with online support can be significantly less expensive.

- **Reduced travel/postage/phone**. With online collaboration, cross-district and regional meetings, travel costs decrease. Online communications can also decrease the overall cost of parent and community communications. Postage for sending out student grades or assessments is saved, as parents can access them online.

- **Reduced Textbooks**. When a school or system decides to invest in technology ubiquity, it invests in learning materials and resources that negate the need for textbook purchasing (the spending moves to digital learning resources). The average price of one high school textbook is $80, so this cost offset is conservatively stated.

This model shows that even with all of the expenditure needed to make technology ubiquity effective, investment can potentially be recovered through cost savings in other areas. While the exact amounts will differ by country and region, this model can be used by system leaders to consider the trade-offs and scenarios that might work in their contexts. Project Red conducted in-depth national research on the economics of providing technology ubiquity in the US. Their conclusion:

> *"Substantial evidence shows that technology has a positive financial impact, but for best results, schools need to invest in the re-engineering of schools, not just technology itself. Properly implemented educational technology can be revenue-positive at all levels—federal, state, and local. Project RED respondents report that technology contributes to cost reductions and productivity improvements—the richer the technology implementation, the more positive the impact."*[103].

[103] Project Red 2013

These findings highlight the need for technology investments to be fully and strategically planned before purchases are made, as we described in Chapter 6. For technology ubiquity to succeed in achieving its potential, all the core components of new pedagogies and their enabling conditions need to be implemented in an aligned and coherent strategy.

Finally, how possible is it to make these 'digital conversion' investments within the overall economics of education? Regardless of whether the final cost is net neutral, education system leaders will need to put arguments to parents, to communities and to political decision-makers in terms of the bigger picture. The cost model above shows an overall cost for technology ubiquity of $220 per year per student, or less than 2% of the average $11,831 per student per year spent on education at the primary and secondary level in the US. However, the US spends significantly more per pupil than most other countries. The OECD average spending per student is $8,595 per year. Even in countries that spend considerably less per student, technology ubiquity is now well within the range of feasibility. Countries such as Mexico, Portugal and Turkey understand this, and are making some of the most ambitious efforts in the world to provide technology to all their students right now. When the cost savings described above are taken into account, there is literally no economic reason for it not to become a reality in the very near future. The question is one of how strategically these investments will be made, how well the technology will be integrated with the other components of new pedagogies and whether the process will be supported with the enabling conditions for truly effective implementation that allow the new outcomes to be achieved.

Whole System Realignment

The spread and effective implementation of new pedagogies across whole education systems is dependent on the policy context and system levers beyond any one school. In previous work, Sir Michael Barber, Michael Fullan and colleagues have written extensively on whole-system reform and change leadership.[104] All of the principles and drivers articulated in that body of work are equally relevant in influencing culture and building capacity for new pedagogies. System-level realignment of purpose, human resources and professional learning strategies, new assessments and accountability measures, collaborative networking, financial resources and new roles for everyone will all bring powerful system levers to the change process. Earlier, we described a new concept of whole-system change that we call 'inherent change', which refers to the ease and speed of change towards new pedagogies – or 'positive contagion' under the right set of conditions. But, just as new pedagogies themselves are currently manifest in more and less effective versions, whole-system change towards new pedagogies comes in stronger and weaker versions. Let us be clear: from our discussions with teachers, school leaders, education system influencers and policymakers, it is clear most of them believe that *system elements are currently the strongest barriers to change*.

[104] Fullan 2010; Fullan 2011; Barber, Rizvi and Donnelly 2012

Effective whole-system realignment starts with a deep learning focus at the core. In many, if not most, of the cases we have seen, new pedagogies are spreading without being fully aligned with formal curriculum, assessment and accountability structures. This puts teachers and students at odds with the goals of the system. The system works as a barrier to innovation. Instead, in systems where we see effective implementation of new pedagogies, all conditions are realigned across the whole system to powerfully enable change. Leaders in these systems invest in the right drivers – a clear vision and focus on deep learning first, then collaborative learning cultures, pedagogical capacity building, technology ubiquity and the other enabling conditions described above. These elements in combination are the strongest versions – where inherent change seems most organic and natural. But as this discussion has revealed, in such cases there is a lot going on beneath the surface.

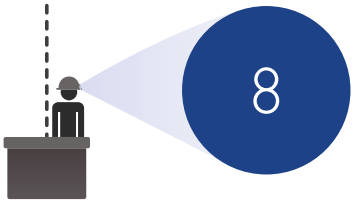
Education policymakers in these systems take different approaches, and change is manifested in different patterns in different countries. In Tasmania, Australia, the system is enabling the rapid spread of new pedagogies across the whole system through the catalyst of professional learning. Leaders are providing the focus through a state-wide 21CLD initiative to help all teachers cross the bridge to new pedagogies:

> *What is clear to me, in my work with schools that are getting traction, the most significant investment is time to support professional development and capacity building around the new pedagogies. The thinking and the work around this is more important than anything else.*
>
> Max Drummy, Professional Learning Leader, Department of Education Tasmania, Australia

In other examples, the entire education model has been or is being restructured to support the system-wide spread of new pedagogies. In cases such as High Tech High, the Fontan schools and Peel School District, the system-level framework, policies and programs are all aligned to integrate new learning partnerships, deep learning tasks and the use of technology to enable and accelerate deep learning.

As we talk about new economies, let us note that by far the biggest new resource of all as new 'rich seams' are opened and mined is how *the learning time of students and teachers* is profoundly liberated and re-focused on better and deeper learning - not just during the school day but accessing learning 24/7. The biggest waste of all is the hours, days, years and decades squandered on boredom and alienation. If time is money, we have the opportunity to become billionaires in learning.

Mobilising whole systems towards new pedagogies is not a small undertaking. It requires nothing less than addressing the fundamental challenges and new potential of education systems in our age. We urge leaders and systems to not embark on these quests alone. Collaborative school, state and system networks are emerging within and across many countries, such as the *New Pedagogies for Deep Learning* global partnership that we are a part of. The good news is that the inherent systems dynamics of the model are so powerful that, to us, they seem unstoppable. The wise leader leverages these favourable conditions. What could be better than everyone – from students to teachers to leaders to whole communities – doing the work that is most valuable, in partnership? And the best news is that we can garner great benefits from these practices at a reasonable cost—metaphorically, twice the learning for half the price.



8 Rich Futures

With countries facing youth unemployment ranging from 14% to over 50%, and with income gaps increasing, it might seem absurd to contemplate rich futures. But that is exactly why we should. New learning, as we have portrayed it, represents the biggest solution of all. The models and practices of our education systems are changing around the world. How quickly these changes occur, whether they will lead to substantive improvements in learning outcomes more relevant for the flourishing of our students and our societies, remains to be seen. This report has sought to clarify a new vision and model for education. It has provided examples and insights into what the core elements of the new model are and how they can be effectively implemented across whole systems. The early evidence that we have presented here, as well as the palpable excitement of the students, teachers and all those involved in implementing these visions, suggests the tremendous potential of new pedagogies to find deep learning.

New learning partnerships between teachers and students are the essential foundations for effective new pedagogies. These partnerships are beginning to emerge naturally as digital access opens the door to broader and more varied sources of content knowledge. As bored students and alienated teachers seek greener pastures, the new learning is a natural attraction. Students begin to take part in defining learning goals, connecting the learning to their own interests and aspirations and becoming more active observers and guides to their own and to their peers' learning and progress. Deep learning tasks build upon the foundation of the new learning partnerships. They challenge students to construct knowledge and begin to use their ideas in the real world. In the process, they develop key skills and the experience of doing 'knowledge work' in ways that develop tenacity, grit, and the proactive dispositions that pave the way to flourishing futures.

To expand these pedagogies to more sustainable, widespread practices that have measurable impact on learning, we must work together to further develop and refine these insights about what these new pedagogies are in practice and their implications for the roles of teachers, students, leaders and policy makers. Systems don't change because only one party takes action. When elements of various constituencies become deeply dissatisfied with the status quo; when they take action, perhaps independently at first, and above all when they begin to converge, change sparks fly and ignite. Thus all of us have a stake in initiating the next stage of reform—one that promises to be as radical as any we have seen since the advent of public schooling in the 1800s. We are at the early stages of a learning revolution that will define in specific terms the citizen of the future as a knowing, doing person who can function productively in a complex world.

Everyone should work on her or his own action list. We provide here some starting points for each role:

Students

- Identify learning partners and mentors among your peers, teachers and communities, and make sure they know your aspirations and interests.
- Reflect on your own learning progress, ask trusted learning partners for feedback and give feedback to them in return; engage in teaching with and learning from your peers.
- Begin to define your own learning goals, connecting your learning to your personal aspirations and interests, and then begin to achieve those goals.
- Push your teachers and fellow students to be fellow learning partners in the pursuit of deep learning.

Teachers

- Begin to practice a partnering approach to learn from and with your students.
- Make sure you know your students' aspirations and interests.
- Identify the deep learning tasks that are taking place in your school or broader community.
- Begin to redefine your learning tasks for and with your students, building in more opportunities for knowledge construction, problem-solving and implementation in the real world, and connecting the tasks to students' aspirations.
- Collaborate with other teachers and stakeholders on what is working to engage and advance student learning.
- Push your colleagues and the principal in the direction of the new pedagogies linked to deep learning.

School Leaders

- Begin to practice a partnering approach to learn from and with your teachers.
- Identify deep learning task examples within your school; share and analyse these tasks with other teachers focusing on how students are engaging and what are the results.
- Develop ongoing rhythms of collaboration with students, teachers, parents, other school leaders and system leaders, all focused on defining, developing and implementing ideas to achieve deep learning goals.
- Identify and develop new ways of measuring student, teacher and school success that all align with deep learning goals and the implementation of new pedagogies.
- Partner with other schools and the district or region for creating a system-wide endeavour into new pedagogies and deep learning.

Policy Makers

- Place building the pedagogical capacities of teachers at the center of all policies and priorities.
- Identify and develop new ways of measuring student, teacher and school success that all align with deep learning goals and the implementation of new pedagogies; Ensure these new systems of measures are used primarily to support learning progress at all levels.
- With deep learning and new pedagogies as the drivers, develop and support holistic digital access programs.
- Reduce negative accountability in favour of building capacity around the new pedagogies linked to deep learning.

The above starting points should be followed by continued research into and learning from the work of implementation. We must think about and study how new learning partnerships at all levels can foster the latent, inherent change that is waiting to happen. We must develop a whole new way to define and measure the success of our education systems based on a different orientation towards their aims. Such measures should shift assessment towards measuring the key elements of deep learning: mastery of the learning process, knowledge construction, and the proactive 'doing' dispositions that we have described. And we must stop centering learning only on covering mandated curricula to prepare for exams that serve the system rather than the student.

Our education system policies and economics must also be realigned. Building the *pedagogical capacities* of our teachers to effectively practice new pedagogies that drive deep learning outcomes should be the new focal point of education policy. Such capacities are the lynchpin for the effectiveness of the new model. And as we have shown, fiscal constraints are no longer an excuse to delay ubiquitous technology in our schools. Pervasive digital tools and resources can be provided for existing levels of funding: it is more a matter of political will than of economics.

History shows us that what we can imagine, we can make possible. To effectively and sustainably implement the kind of learning model described in this report, we need sustained collaborative efforts to mobilise whole systems to learn together. Three new forces—new pedagogies, new change leadership and new system economics—are converging with broader social, economic, technological and organisational contexts in a manner that presents the most favourable conditions for transformation in over a century. The time has come to take advantage of this once-in-a-generation opportunity. Whole system change has never been more achievable.

The ultimate goal is interdependent learners who have the abilities, dispositions and experiences to truly make the most of the extraordinary world of information, ideas, creativity and connection that digital access opens up. Young people and adults alike have the natural instinct to learn and to create. This is what new pedagogies can unleash. But we have also seen that this unleashing should not be unstructured. Our schools and our pedagogies need to inspire and to ensure that *all* students are capable of independent learning and purposeful action in the world, and have not only the foundation, but also the practical experiences and technical skills to create valuable futures for themselves and their societies.

The new pedagogies model promises to drive out of our schools the boredom and alienation of students and teachers—an incredible waste when there is so much to learn. The next decade could be the most transformative of any since the creation of factory-model schools 150 years ago. Imagine a future were students and teachers can't wait to get to the learning – where indeed school never really leaves them because they are always learning. We see the directional vision. We detect elements of it in reality. We can taste the possibilities. It is a future that is distinctly possible to realise. It will take the learning ingenuity of the many. It is a rich seam worth opening.

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