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# **Deep Learning: Shaking the Foundations**

**A WHITE PAPER BY**

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**New Pedagogies for  
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*The ideas in this paper are by and large the creation of this group, and the colleagues we work with around the globe.*

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## Preface

Our interest in deep learning began during 2012. You could say it was like noticing but not quite ‘reading the tea leaves’. Certainly, we shared a growing unease about the nature and performance of schools and school systems. Even those countries that were doing well on conventional tests—Finland, Canada, and others—did not seem particularly satisfied with their relative success. Good performance on tests notwithstanding, there seemed to be a lack of confidence about the kinds and levels of learning outcomes being achieved. So much learning seemed superficial in light of the rapidly growing demands of the 21<sup>st</sup> century. Deep learning, though poorly defined, became the rallying cry for what was needed.

What followed rapidly in the ensuing four years was a groundswell of interest and discussion around what deeper learning might be. We encountered ad hoc instances of ‘out of the mold’ activity, but saw little system action. Today, this has all changed and deep learning has become better defined and has moved center stage in policy discussions.

In this White Paper we do not seek to provide a detailed review of the field, but rather an immersion in the issues and actions in the pre-K -12 school system that are rapidly forming what might become a social movement. We will not address movements that are counter to overall systems improvement and deep learning. Only to say if they fail to generate widespread deep learning they will fail.

We define deep learning later in more depth but for now let’s say that it concerns a radical re-positioning of the learning relationships among all the major players: not only students, teachers and families, but also educators at all levels, policy makers, and society as a whole. Additionally, deep learning focuses on a set of fundamental learning outcomes that represent a *system change*. It is for these two reasons that we view it as an emerging ‘social movement’.

Our thinking in this paper has been especially informed by our development and participation of in the global initiative ‘New Pedagogies for Deep Learning’ ([www.npdl.global](http://www.npdl.global)) that involves seven countries and over 1,000 schools: Australia, Canada, Finland, Netherlands, New Zealand, Uruguay, and the United States. For the past 5 years we have been immersed in the factors that hinder and facilitate the adoption of deep learning in systems, schools and classrooms. In this work we have been interacting with a broad range of those involved in the deep learning movement ranging from very young children to policy makers. In NPDL we have

been working in partnership with schools to change the nature of learning through changes in: pedagogical practices (such as collaborative inquiry); learning partnerships (between and among students, teachers, families and communities); learning environments (the redesign of learning within and external to schools); and leveraging digital (for deeper learning). We are focusing particularly on global competencies that we call the 6Cs: character, citizenship, collaboration, communication, creativity, and critical thinking. In this paper we draw from this work but do not report on it systematically (for the latter, see Fullan, Quinn, & McEachen, forthcoming).

Our focus here is on what deep learning is and why it matters, how far it has developed in schools and classrooms over the past 5 years, and where we expect it to lead. We will find that deep learning is very much at the early phase of development facing certain obstacles embedded in the status quo, but we will also argue that the forces favoring the further development of deep learning are considerable, including the potential massive mobilization of students and teachers toward a new world of learning that ‘engages the world to change the world’ as a personal and collective way of fulfilling ourselves.

# Chapter One: Deep Learning—What it is and Why it Matters

'Deep learning' has come to the forefront of the educational lexicon and claimed the attention of teachers, school administrators, educational policy makers and funders around the world over the past four years. We, along with our international team, have been immersed in trying to understand its nature and impact by jointly implementing deep learning in schools and school systems in several countries. At the same time, we have been tracking what has been happening elsewhere in the field of deep learning.

We have been particularly interested in understanding the conditions under which deep learning is associated with change across and within an entire school system. Often, deep learning can and does start in disconnected pockets: one or few students, classrooms, school, or district. If conditions are favorable, more instances are generated. They connect laterally (within the same level), and vertically (between levels) and can operate more as a social movement rather than as a conventional reform initiative. It is often impossible to control the course taken by such a movement, but one can facilitate it, by addressing barriers, by creating or strengthening conditions and practices that enable the adoption and spread of deep learning, and by trying to sort out what does and does not work.

What can be said with some certainty at this point in time is that the forces for deep learning have been unleashed. Deep learning has arrived, and is set to become more prominent. Second, *leadership* for system transformation will have to come from all quarters, and indeed it is equally important that it come from the bottom (students and teachers as change agents) as it is from the middle (school networks, districts) and the top (provinces, states, nations). Third, the outcome of this movement is not clear for two reasons: because it contains the seeds of upheaval as innovation involving scores of students and other educators evolve; and because the world environment is volatile on almost every dimension.

## What is deep learning?

So what is deep learning? One could say that *true learning* is by definition deep in the sense that it is enduring, as opposed to shallow learning that tends to be transitory. Pellegrino and Hilton (2012) in their landmark review of the research literature, define 'deeper learning' as the process through which an individual



becomes capable of transferring what was learned in one situation and applying it to new situations (see also Bellanca, 2015).

Transferability is a litmus test to whether deep learning has occurred. A fundamental rationale for deep learning in a volatile and constantly changing world is to equip learners to deal with change and new challenges, to be lifelong learners and to be able to apply (i.e., transfer) what has been learnt to new situations. While acknowledging the centrality of transfer in defining deep learning, we would argue that in current educational parlance, the term has appropriated and accrued additional important meanings that go beyond the strictly psychological definition of Pellegrino and colleagues and that seek to embody the kind of guidance needed to maximize the probability of transfer.

Our definition of deep learning is ‘the process of acquiring the 6 global competencies also known as the 6Cs’ (Fullan, Quinn & McEachen forthcoming). Deep learning consists of several or all of the following attributes. It is the interaction effects of these elements that make for deep learning:

- involves higher-order cognitive processes to reach a deep understanding of core academic content and key issues of the contemporary world;
- includes immersion in addressing an area or issue, often crossing disciplinary boundaries;
- integrates academic and personal/social capabilities and gives priority to those competencies and dispositions that support learning and living in the 21st century;
- is active, collaborative, student-centered, and personally relevant;
- is challenging and manifestly worthwhile;
- in some way is designed to connect to and impact the world, locally or wider;
- takes place in a range of settings, but increasingly incorporates the medium of digital technologies and connectivity; and
- is for all and especially for students who have traditionally been disconnected and underserved by conventional schooling.

In a nutshell, deep learning is about individuals and groups really understanding and engaging in something that is important to them, and of value to the world. It uses the changing world as the crucible of continuous transformation.

## Deep learning: Why does it matter?

There are signs that we are approaching a new watershed in thinking about the role and importance of education and how it is provided. The need for radical

change has become palpable as fundamental problems of the traditional model have become increasingly obvious and felt simultaneously at the macro (whole of society and system) and micro (individuals and local) levels. The big picture and small picture are now on the same page for an increasing number of people of all ages.

This all comes about as a consequence of changes in the world we live in. There has never before been a time of such revolutionary ferment as the world is now experiencing. What is more, unlike previous upheavals, the changes and challenges are happening at lightning speed and are global in their impact. There have been predictions that a high proportion of current occupations will disappear over the next two to three decades as a result of automation, artificial intelligence and other technologies such as 3-D printing (Frey & Osborne, 2013; Deloitte 2016), and these are no longer just the low skill jobs, but include high level occupations in areas such as engineering, medicine and law (Pink, 2006; Schwab, 2016; Thompson, 2015).

On the other hand, there is also evidence that many companies that are not eliminating work are either retraining people to use technology or are redesigning jobs to better take advantage of human skills. (Schwartz, Collins, Stockton, Wagner, & Walsh, 2017). Undoubtedly new occupations will emerge, but high levels of formal employment of the kind that we have known for generations may become a thing of the past, with enormous consequences for how people can spend their time in meaningful ways, for how families without work income are supported and how social cohesion can be maintained where the divide between haves and have-nots could become unsustainable. This could lead to and require dramatic changes to the way society is structured.

Professor Klaus Schwab (2016), Founder and Executive Chairman of the World Economic Forum in his arresting and insightful book *The Fourth Industrial Revolution*, observes that: "The changes are so profound that, from the perspective of human history, there has never been a time of greater promise or potential peril." Moreover, the key macro forces at work are uncontrollable. Whether you take Joshua Cooper Ramo's (2016) 'age of networks', or Parag Khanna's (2016) 'connectography' the trends are the same, and they are deep, powerful, unpredictable and relentless: devolution, connectivity, aggregation, acceleration, and the fluency and redistribution of power. The average person may not fully grasp what is happening, but almost all sense and feel that *something powerful* is going on. In short, we are on the cusp of a fundamental turning point in human history. This implies that: we all need a greater depth of



learning than ever considered necessary or achievable in the past, but also a greater consciousness of these fundamental changes and our place in the world.

Meanwhile at the micro or individual level we have a mixed bag. Curiously, students (and their parents) who do well traditionally are often worried more about grades than about relevance to their personal life or to the world. In the movie *Most likely to succeed (MLTS)*, high school students in a senior math class bluntly say that they would rather be taught 'how to ace the test' than 'how to apply math in life or on the job'. Their rationale: we need grades for college; we can catch up to the 'real world' later (see also Wagner & Dintersmith, 2015).

Many other students find that regular schooling is boring. Most surveys find that only about one-third of students are engaged by the time they reach high school – a trend that begins around grade four and intensifies from thereon (Jenkins, 2013). And then there are the scores of under-served students: children and youth of poverty, students of color, or with special needs. Inequality becomes more pronounced and persists to the detriment of both individuals and society (OECD, 2017). All in all, large proportions of students stand to miss out on the future. Again, to anticipate where we are going, we need to revamp education that sparks the interests and engagement of *all students* which means that we need to give students learning experiences and successes that they never knew were possible.

The good news is that once the 'deep learning seam' is opened things can move incredibly rapidly and at scale. One of the most radical and powerful ideas that we are pursuing is what we call 'the equity hypothesis' (Fullan and Gallagher, 2017). We propose that while deep learning is necessary for all, it is especially essential for students most alienated from regular schools and could be a force for reversing the damaging effects of concentrated, intergenerational poverty and racism (Noguera, 2017).

The challenge for school systems could not be clearer: we fail future generations and put at risk the very survival of our planet and our civilization if we don't prepare children to understand and master the forces of disruption and innovation transforming our lives. For it will fall to them to ensure that the greatest perils are avoided and the highest hopes and promises are realized for all.

Deep learning is a critical piece in trying to ensure that young people don't become victims in the volatile, unpredictable, complex and ambiguous world we and they inhabit, but rather become confident, empowered individuals with ambition, vision and a passion for creating a better world for themselves and for

everyone else. The future wellbeing of the world requires deep learning helping to change it for the better.

## Chapter Two: The Current Scene

There has been a great deal of talk over several decades about the need to give greater prominence to 21<sup>st</sup> century learning skills. This talk has intensified and many groups have become actively engaged in pursuing deep learning and its associated skills. One of the best scholars involved in this work is Jal Mehta and his colleagues from Harvard. Mehta and Fine (2015) set out to ‘map the landscape of non-elite public high schools that are enacting deep learning’ (p.10). They used their considerable network to identify and visit schools across the USA. What they found (and note that these were selected to be best examples) were ‘startling gaps between aspirations and realities’. ‘We had hoped’, they say, ‘to be inspired but instead we felt profoundly disheartened’ (p. 10). They did find individual classrooms here and there that reflected deep learning, and the odd school had promise, but little else.

Our own experience coincides with that of Mehta and Fine. We feel confident in concluding that currently there is little by way of deep learning (as we defined it in the previous chapter) occurring in public or private schools in the U.S., and what does occur is *ad hoc*.

At the same time, a number of schools and school networks have emerged over the past decade that are intentionally pursuing an educational agenda that’s very consistent with deep learning. These include High Tech High, Big Picture Learning, New Tech Network, Envision Education, EL Education, and EdVisions Schools, and Project Lead the Way (Hoffman, 2015; Lathram, Lenz & Ark, 2016). These networks align with the eight criteria of deep learning that we set out in chapter one. The trouble is that networks of this sort encompass a single or small numbers of schools, albeit widely and justifiably admired. What is needed is widespread and rapid transformation of *entire school systems*. Before turning to a framework for bringing about this transformation, however, it is necessary to identify the barriers to its realization.

The relatively low level of cognitive demand required in most standardized tests is one of the most significant barriers, because it creates a negative incentive for teachers to engage in deep learning, which by definition involves higher-order cognitive processes. Pearson’s research section undertook a rigorous analysis of the depth of cognitive demand in math and science examinations set by examination bodies in several high-performing countries (Clesham, 2013). It revealed a low level of cognitive demand in the questioning and shallow coverage of wide bodies of content across all of the countries investigated. We suspect

that an analysis of AP exams, State tests and college entrance tests would also reveal low levels of cognitive demand.

Other barriers to the adoption of deep learning include:

- the time needed for deep learning and the problem of curriculum content overload that leaves no space for deep learning;
- the demand from higher education for content coverage;
- the standard organization of the school day, particularly in secondary schools, with timetables built around short (in many cases 40-minute) lessons, which in effect disrupt learning and do not allow the time to go deep;
- the limitations of formal testing programs, examinations and accountability systems in assessing and valuing deep learning and their reliance on short response answers and on tests that can be completed in 60 minutes or less;
- teachers' professional practice and their ability and willingness to adopt a role that positions them not as the 'knowing other' so much as the guide and facilitator;
- the absence of tools for teachers to assess the outcomes of deep learning; and
- the parlous state of teacher professional learning that for the most part fails to equip teachers with the pedagogical skills needed for fostering deep learning.

Over and above these structural barriers, there are cultural barriers to overcome in the form of the default culture of schooling, or the established institutional culture and power relationships that permeate the everyday lives of students, teachers, and administrators, and shape everyone's (mostly incorrect) beliefs on what learning is about, what counts as appropriate behavior, and what is the nature and source of knowledge. It is not only *teachers'* ability and willingness to adopt a new role, but the whole '*mind-set of schooling*' that we all own, from students to policy makers as well as almost every adult who went through school, that constitutes the largest blocker.

For these reasons, we are not even close to realizing any degree of deep learning in public schools. A few individual schools engaged in deep learning does not count as system progress. Perhaps the real issue is whether external trends will force systemic change or whether educational systems will take up the challenge and play a proactive role in shaping and promoting it.

In the rest of this paper we address the question of what it will take to get deep learning ubiquitous as a system movement. We propose a simple two-level framework:

- *Micro or local* level: students, teachers, school and district administrators and parents and
- *Macro or system* level: school systems, higher education, employers, R&D (both commercial and university based), and policy makers.

## Chapter Three: Micro-Level Change

In this chapter we focus on the local level: school and community, district and municipality. As a reminder, we are not simply pursuing and highlighting isolated instances, but also exploring what it takes to get a critical mass of players at the local level to embrace deep learning. We first take up the nature of deep learning at the school and community level; second we present a more formal definition of the components of deep learning at the school level; third, we examine the role of school districts in deep learning; and finally we address these developments as a set in terms of the nature of the change in culture required at the school and district levels. All of these descriptions are inspired by what we are observing and learning in our NPD L schools, and in similar schools and school networks engaged in making deep learning a reality.

### The nature of deep learning

In this section we set out to identify what excites teachers and school leaders, and inspires them to want to embrace deep learning themselves as well as legitimating them in doing so. We want to paint a picture that is not narrowly focused on the end results, but highlights the issues that teachers, principals and school leaders have had to confront and overcome in making changes, including such actions as identifying the teachers to lead the change, reconfiguring the school day, making space for deep learning, accepting a very different style of learning, developing teachers' understanding of and capacity to implement deep learning, explaining the changes to parents, dealing with new forms of assessing students and new ways of reporting on their achievements, and so on.

As Jal Mehta and Sara Fine (2015) have pointed out, deep learning is captivating (even though they found few examples of it in practice). Things may be changing. We present in Vignette A some examples of early attempts to unleash deep learning drawn from our NPD L schools. In these schools you will see students moving constantly around (even between rooms in the school) to ask questions to their peers or their teachers, to see the work of others, or to look for information or learning tools they need at a given point in time. You will hear a constant buzz made up of the multiple conversations taking place, most of them centered around the work students are doing, the questions or dilemmas they're facing, and the strategies they're using to make sense of their topics of study. Everyone seems highly focused on the work. In fact, if you have come to these places as an external observer, the people in the group will likely not notice you're there until you get closer to someone to see their work and hear what they're saying. You

will also notice that students seem unaware that time is passing – they may be surprised when the time for recess or the end of the day comes – and that they continue to talk about their work during recess, at home, or on weekends. Students work harder, but they don't seem to mind. They actually seem to *want* to work harder.

Whether these are examples of what deep learning could become is not so clear. We will need to see more instances that stretch students and require them to go deep as a matter of course. We offer these cases, then, of early attempts to open the door to deep learning.

### **Vignette A: Examples of Deep Learning Around the World**

Robotics kits had arrived at a middle school in a poor urban neighbourhood in Uruguay, but were left packed and unused for months. One day, the students asked the teacher if they could use the kits to create simple robots that could solve a local problem of their choice. They had never used kits of this sort, but with a clear purpose in mind and using video instructions available online, they figured out how to use them. One of the students created a motion detector to be placed in gardens, to sense the presence of birds and vibrate to scare them away. A small group remembered that some time ago lightning hit their local beach and killed 5 people, including a young boy, so they decided to create a lightning detector that could sense in advance whether lightning was going to hit the beach and ring an alarm to warn people to look for shelter. (Watch a video with this story at: [youtu.be/x8VKDggf\\_i4](https://youtu.be/x8VKDggf_i4))

After three siblings from Georgia saw their family being unfairly harassed by the police, they created Five-O, a mobile phone app for people to rate their encounters with police. Incident reports recorded by citizens can be shared and used by communities to rate individual officers and police departments. To create the app, the students used coding skills they had learned online. (Prensky, 2016: 16). A video about the app is available at: [www.huffingtonpost.com/2014/08/18/teens-police-brutality-app\\_n\\_5687934.html](http://www.huffingtonpost.com/2014/08/18/teens-police-brutality-app_n_5687934.html).

Grade 1 & 2 teachers in Victoria, Australia, designed a long-term project around one student's dream of building a mini-library for the Malaysian community he was returning to, after beginning his education at a primary school in Australia. Teachers designed learning experiences for the



students that helped them to collect books, write persuasive letters to publishers, design and write their own stories, and organise fund-raisers to help pay for the shipping of over 600 books to Kuala Lumpur. The mini-library has now been set up in Kuala Lumpur and negotiations are underway with the Malaysian education authorities to create a mobile library that can take the books out to children in the suburbs of the capital city. The students who participated in this project are able to articulate how their actions have made a difference in their lives and the lives of others. (See <http://fuse.education.vic.gov.au/?7G7NGB>)

Grade 6 students in a classroom in Santa Monica, California create video tutorials where they explain how to solve specific math problems, and post them on a website open free access to anyone in the world. In a workshop-like environment, students tackle math problems of their choice, record their thinking and solutions, discuss them with peers working on the same problem, and make videos using an interactive video design software to explain their solutions and the reasoning behind them. (November, 2012). (To watch some of the tutorials, log onto Mathtrain.TV).

Junior high-school students at High Tech High in California are asked to write, produce, and perform a play based on Euripides' tragedy Trojan Women, adapted to modern day Pakistan. In the process, they dive deeply into the study of democracy, human rights, women's rights, 5th century Athens, and today's Afghanistan, but also develop the technical and moral knowledge and skill that comes from taking responsibility for the whole production of a play, to be performed live for parents and the larger community at the end of the academic year. In another class, students are presented with an overarching idea: Over the centuries, different civilizations have come to be and gone away. They are asked to select any civilization they want, and develop a theory that explains why it arose and why it fell. Next, they have to create a physical manifestation of their social theory using a variety of materials including wood, gears, cogs, bands, etc. The materialized theory of each small group will be assembled into a larger mechanical piece to be showcased at the end of the academic year. (From movie Most Likely to Succeed – <http://www.mltsfilm.org>)

In a digital media class of a public High School in Northern California, students plan and run a live recording of a soccer match (including capturing the match through multiple video cameras, coordinating the projection on the live show in real time, narrating the game live, etc.). The same group has been broadcasting a weekly TV show, produced and

managed by students themselves. In an arts class of that same school, students create remarkably beautiful and expressive carved large-format prints portraying important moments of the civil rights movement, after having studied in depth a collection of key historical documents. Students undertake all the activities involved in creating the prints, the way professional artists do. Their art will be featured in a public art gallery. (Fullan, Rincón-Gallardo, & Watson, 2016)

A First Nations student was struggling in high school in Timmins, Ontario having left his community and culture behind, traveled hundreds of miles away to attend school in a community where many people expected First Nations youth to fail, and boarded with a family he didn't know. When he learned about a program called Students as Researchers sponsored by the Ontario government, he talked to a few other students from his community and soon they had a group that would explore the experiences of First Nations youth when they transition to high school. They designed surveys and interview questions, and gathered evidence from students who had survived the transition and graduated, students who had dropped out, elders in their own community, students and staff in their school, and members of families who provided room and board to First Nations' students when they came to the city. By the end of the course they completed their report, a litany of challenges and barriers ranging from loneliness to racism, to feelings of hopelessness and failure. With the support of their school and some of the elders of their community, they formed an Aboriginal Youth Advisory Committee at their school. This council gave aboriginal youth a voice, and allowed the students to lead the changes needed in their school: aboriginal mentors, peer tutoring, activities designed to celebrate First Nations cultural events and steps taken to change the host family experiences and connections to the community. (Fullan and Gallagher, 2017)

In these beginning examples you certainly detect significant differences from what is all too common in conventional classrooms. Approach students and ask them about their work, and most will be able to articulate, on the spot, what they are doing and why, what they are learning and how, why it matters, to what extent and in what ways they have gained mastery of what they have studied and of the skills needed to be an expert learner, and what are key areas where they need to get better at and their plans to do it. Many will show you – proudly – some of the work they produced and point to parts of it as they explain their

learning. Ask them what they think about this way of working and you will hear genuine signs of excitement, self-efficacy, and hope.

Look for some examples of student work and learning tools being used in the classroom and you will start to see the varied ways in which students connect with the outside world as part of their regular activities: blogs, podcasts or videos produced by the students to make their learning visible to a wider audience. When available, many students will be using an Internet browser to search for information or digital tools they need to make sense of the problem or question they're tackling. You may find evidence of exchange with experts in the fields that students are learning about – either because the experts visit the school or hold a virtual meeting with the class to provide feedback on their work, or because students visit the experts in their workplace to gain exposure to their practice.

Now follow the adult(s) in the room and observe their interactions with students. While every now and then they may request the attention of the whole group to make a short remark or briefly provide direct instruction, most of the time they will be moving across the room, engage in learning-centered conversations with individual students or small groups. When an educator interacts with students, she listens attentively to what they have to say and remains alert to evidence of what the students have learned, how they are thinking about the problem or question at hand, to what extent they are transferring knowledge and skills learned previously to tackle a new situation, or what misconceptions, mistakes, or dilemmas remain unresolved. Only after careful listening does the teacher offer feedback, ask a carefully crafted – although most likely unplanned – question to help students find their own answer, or suggest possible next steps. You will also see signs of affection between teachers and students – a tap on the shoulder, a smile, a joke followed by a big laugh.

Adults in the room are constantly learning in public in a variety of ways, which might include:

- saying 'I don't know' when they don't have an answer for a student;
- learning about a topic or how to use a digital learning tool from a student who has gained mastery of it;
- openly making mistakes, acknowledging and correcting them;
- expressing surprise and curiosity when a student comes up with a good solution, idea or approach that they had not thought about;
- acknowledging confusion and going through it in public;

- expressing aloud what and how she's thinking about and through a puzzling question or problem;
- publicly opening her most hard-wired assumptions to scrutiny.

Now pay attention to the color of the skin, the gender, or the physical mobility of students in the group. You may be surprised that the quality and degree of challenge of the work being done, and the treatment from other peers and adults remain equally demanding and respectful no matter what the student looks like. The notion that students who have historically struggled with school need to master the basics of literacy and numeracy first, before embarking in deep learning endeavors, is absent in classrooms that have embraced deep learning. Indeed, as many of the educators who have embraced deep learning are starting to articulate: if there is no equity, it is not deep learning.

If you happen to be in one of those unlikely sites where *the whole school* fosters deep learning on a regular basis, shadow some teachers for a day and you will become aware of the multiple occasions on which they interact with their colleagues and the principal – formally and informally – to talk about and strategize on pedagogy and student learning. Furthermore, it won't take long to notice that teachers as well as adults have multiple opportunities to experience deep learning themselves in their everyday work. They have the time and space to explore topics or learn to use digital tools that they don't know much about, but in which some of the students are deeply immersed. But most importantly, they will very likely have time allocated to do regular joint work with their peers to analyze student work, assess whether and how deeply students are learning, examine pedagogical practices in light of these assessments, and continuously devise, test and refine their strategies to enhance and deepen student learning. As in the case of students, if you ask them about their work, teachers will be able to articulate on the spot what their students are doing and why, to what extent and how deeply they're learning, what is working and what isn't in their current practice, and what their plans are to get better. And it won't take much effort to perceive the genuine sense of excitement, pride and hope in their words and expressions.

Visit the school for a few days in a row and you will quickly notice the active role parents play in the learning of their children. Parent meetings are mostly focused on student learning. Meetings are used most prominently to do things such as discussing what students are expected to know and be able to do as a result of attending school, looking at demonstrations of student learning, or clarifying why the work students are doing is so different from the schooling experience of parents and teachers. By contrast, administrative and logistical announcements

use up only a minimal part of the agenda. You may realize that the notes sent home by teachers are much more likely to request parents to discuss with their kids a topic or question they're exploring rather than remind them of homework or more menial tasks.

This is deep learning in action as can be observed in multiple – although still proportionally very few – classrooms and schools around the world. The portrayal just presented is consistent with what recent discoveries of the science of learning suggest about the immense capacity and biological need of the human brain to learn and about the conditions that enable powerful learning (Doyle & Zakrajsek, 2013; Medina, 2014). Learning environments such as the one just described leverage on and feed the three key drivers of intrinsic motivation Daniel Pink (2009) identifies in his classic book *Drive: Mastery, Purpose, and Autonomy*, or what Mehta and Fine (2015) call 'mastery, identity and creativity'. Our own definition, stated in chapter one, is entirely compatible, except that we have added two fundamental elements: i) that learning and doing something that is immediately valuable to the world (locally and/or globally) is a defining aspect of our humanity; ii) that learning with others, in teams working on something important is an *intrinsic* motivator—right up there with mastery, identity, and creativity. Becoming a citizen of tomorrow today is essential for today's deep learners. Or as Marc Prensky (2016) puts it, education should be about improving the world, and having individuals improve in that process.

In many ways, deep learning is easy to identify and relatively simple in its basic principles. At the same time, it is fundamentally different from, and runs against the grain of, conventional schooling. And decades of research on reform implementation make it clear that the default culture of schooling – both in schools and in school systems – is highly resilient and voracious at devouring, neutralizing, or assimilating any serious effort to transform it (Cuban, 1984; Sarason, 1982). Because of its inherently countercultural nature, developing deep learning in classrooms and schools requires hard work and deliberate efforts at identifying, navigating and resolving the inevitable tensions that arise when the extraneous practices and mindsets required to foster deep learning make their way into schools.

In classrooms and schools that have succeeded at embedding deep learning as regular practice, the initial efforts are often started by educators, school leaders, and sometimes students, who are ready to embrace and try out fundamentally different ways of working. Establishing a clear and appealing vision of what students are expected to learn and be able to do, reorganizing the schedule to secure extended blocks of time, creating time and space for teacher collaborative

inquiry centered on examining pedagogical practices to deepen student learning, and creating venues to communicate to parents the new direction taken by the school and listening to and responding to their concerns are some of the strategies that can facilitate the introduction of deep learning in schools.

But by far the most powerful driver to mobilize the deep learning agenda is witnessing visible and often substantial improvements in student learning and engagement as a result of introducing in classrooms pedagogies that effectively foster deep learning, followed by the testimony of teachers who have experienced the power of deep learning themselves. Encouraging visits to classrooms where deep learning has been implemented, as well as facilitating constant communication between teachers who embrace deep learning and teachers who are less enthusiastic about it are thus useful strategies to spread deep learning to new classrooms. It is the enthusiasm generated by experiencing and witnessing deep learning that creates a powerful force to change the default culture of schooling from the inside out: trying out deep learning in classrooms, collectively identifying the school conditions and practices that enable or constrain the consolidation and sustainability of deep learning, and making strategic decisions to strengthen the enablers and weaken the constraints.

## Role of districts in deep learning

While the goal is for system change, the local unit of transformation is often *clusters* or *networks of schools* (in North America this would be districts, individually or in networks; in New Zealand, for example, it would be networks of schools or Communities-of-Learning—COLS as they are called; in Finland the municipality is the local unit).

As mentioned earlier, deep learning runs counter to the established culture and power structures of schooling. Schools and clusters that set out to advance a deep learning agenda often encounter important barriers to their intentions. Some of these barriers have been listed in chapter two. Broadly speaking, they include structural barriers (e.g. grouping students by age; school schedules organized in 50 minute sessions, each for a separate subject matter; constraining curricula that emphasizes breadth over depth of knowledge; and high-stakes assessments that privilege reliability over validity) and cultural barriers (e.g., teachers' low expectations of some students; a culture of schooling whereby knowledge and authority are assumed to be concentrated in the hands of adults; and more broadly, the default culture of schooling). Along a similar vein, Mehta (2016) has identified: *10 Ways to Die with Deep Learning*. (In chapter five we give the reader our '10 Ways to Make Deep Learning Live'):

1. If you haven't experienced deep or powerful learning yourself.
2. If you are unwilling to change the grammar of schooling.
3. If you don't respect your students in the present as opposed to the future.
4. If you don't give students some choice.
5. If you don't live by 'less is more'.
6. If you aren't willing to admit that you don't know the answer.
7. If you don't normalize failure and create opportunities for revision and improvement.
8. If you don't help students feel like they belong in your class and your domain.
9. If you aren't willing to set the world a little askew.
10. If you don't realize that creating deeper learning is a counter cultural enterprise.

School districts have a fundamental role to play in simultaneously enabling the practices and mindsets that nurture deep learning and neutralizing or removing the barriers to the consolidation and spread of deep learning across the system. We discuss the district role in more detail below, but undoubtedly the most important things districts can do to enable the spread of deep learning are to: 1) establish a clear and actionable vision for deep learning and place it at the center of the district's agenda; 2) create multiple opportunities for students and adults to observe powerful pedagogies for deep learning, try them out in their own classrooms, and get ongoing support and feedback from trusted colleagues or mentors; and 3) nurture a culture of innovation where adults and students alike feel safe to try new things out, fail, learn from failure, and get better as a result.

We take as a good illustration one of our case studies in Ontario—the Ottawa Catholic School Board—(OCSB). The district consists of 84 schools in total. They began in year one (2014-5) with 7 schools, expanded to 15 schools in year two (2015-16), and included all 84 schools in year 3 (2016-17). While deep learning is yet to be a regular occurrence in every classroom and every school at OCSB, the district has developed conditions that set a fertile ground for the system-wide spread of deep learning. There is no doubt among OCSB educators, students and parents that deep learning is a *system-wide endeavor*. In Vignette B we provide a glimpse of *what* OCSB has accomplished so far. Then in Vignette C we address perhaps the more revealing question of *how* they progressed from a small-scale start with 7 schools to getting all 84 schools on board within three years.



## **Vignette B. Deep Learning District-Wide: A Glimpse into the Future (\*)**

Visit the Ottawa Catholic School Board (OCSB) and you will experience a system where learning – of students and adults alike – is visible at every layer of the district’s activities. Let’s take a look, layer by layer, from the inside out. In some of the schools that are leading the way on pedagogical innovation and learning environments in this district, you can see kids moving freely within and between 3 or 4 rooms over extended blocks of time, working individually or in small groups on tasks of their choice – either selected from a variety of tasks carefully designed by a team of teachers or co-created between students and teachers – constantly presenting and refining their ideas to their peers and the adults in the room. Each student works at their own pace and in the space of their choice – the space each student finds comfortable and helpful for the task at hand, either in one of many work stations set up in a classroom or in one of several nooks placed in the hallways of the schools for students and adults to work. No assigned sitting, no rows of individual chairs and desks. Some kids work around tables, others sit or lie on their bellies on a carpet to read a book, others sit on rocking chairs, cushiony seats, couches, or a foyer in the hallway while working on a tablet to find information, create animated stories, solve a problem, or read; yet others stand up next to each other while discussing a text, a personal note, or figuring out how an artifact of interest works. There’s constant movement and the buzzing sound of kids and adults in one-on-one or small group conversation with each other, but everyone seems highly focused. There’s very little presentation from the adults in the room to the whole group. Instead, teachers move across the multiple learning spaces to engage in one-on-one or small group conversation with students. Adults constantly ask students to articulate what they are doing and why, and offer feedback to their work. They are also available to respond when students have a question or feel stuck, and intervene when conflict or another problem arises in a group of students working together. Whole-group activities are brief and agile, and used to make announcements for the class or to share insights and questions from individual students and small groups with the larger group.

In these schools, there seems to be a learning function in almost every aspect of the school building. Old, slow and underused school libraries have been turned into learning commons: open, vibrant spaces for study

and collaboration, with ample space to walk around, movable furniture for flexible use of the space, projectors that students can access at any time and tablets and other digital devices for borrowing. There is Wi-fi across the entire building. Students are allowed to and often bring in and work with their personal devices. Floors in the hallways have different sections painted in different colors to identify areas for work and areas for circulation. There are green walls through the building for students to record videos to which they can later add moving or still backgrounds. There are small glass-covered holes in the walls here and there that reveal the internal structure of the building, with bar codes that can be scanned to find information about that part of the building structure and how it functions. Colorful student-made art is displayed across the hallways, in the form of large murals on the walls, painted panels encrusted on the ceilings, or posted on large boards.

Teacher and principal learning is a constant and highly visible activity in these schools and across the district. Teachers meet often to work in teams, either by grade or in cross-panel fashion – teachers from multiple grades in elementary schools, or from multiple departments in intermediate or secondary school – to co-plan and co-design common learning activities, examine student work to identify depth of understanding of the topics at hand and degree of development of core skills such as collaboration and citizenship, identify areas of improvement, and constantly refine their practice. But the visibility of teacher learning is not confined to teacher collaboration during prep- and planning time. It carries over to classrooms. There are schools where learning alongside or directly from students has become part of the regular activities of teachers, either to explore ideas or questions students come up with which teachers themselves don't know the answers to, or to learn to use new digital devices or resources teachers are not familiar with.

Principals and district administrators also learn in public. They learn from students when they attend student-led workshops or tutoring sessions to learn how to leverage digital devices and resources to enhance their own learning and improve their pedagogical practice; they participate in learning walks to constantly refine their skill to observe classroom practice, and offer teachers useful feedback focused on improving and deepening student learning; every month, all principals attend a Catholic Learning Leaders meeting, together with district coordinators and superintendents, to share and develop solutions to their problems of practice; and they also model learning in their meetings with staff.

Classroom and school activities and learning environments like these offer glimpses into the future of learning. They are yet to become the norm in every classroom and every school at OCSB. But they are not isolated examples: they are an integral part of a longer term, system-wide effort to embed new pedagogies for deep learning in the everyday activities of every student and every teacher in the district.

(\*) Extracted from Fullan, M., Rincón-Gallardo, S., and Rodway, J. (2016) Deep Learning at the Ottawa Catholic District Board. Case study draft.

As we turn to the matter of *how* OCSB accomplished system-wide change, we have identified five key components of their strategy (and in Vignette C we provide a snapshot of how their strategy was enacted):

- ***Setting a System Vision for Deep Learning Centered on Students and Grounded on Core Values.*** The senior leadership team at OCSB recognized that deep learning had to be embedded in every aspect of the board's work. A district vision for deep learning has served as the basic point of reference to orient the work of the board, to review existing initiatives, let go of those not aligned with the core vision, and to develop and select new initiatives that support the consolidation and spread of deep learning across the system.
- ***Adopting a precise and operational definition of deep learning and the pedagogies that nurture it.*** The NPDL initiative itself provided tools and rubrics to assist schools and districts to focus on deep learning. These tools, such as learning progressions and task design and assessment rubrics, offer an important degree of specificity and precision as to what learning and learning tasks look like at different levels of depth. Districts and schools observed that such tools helped them focus, but did not constrain local decisions.
- ***Linking Innovation, Pedagogy, and Technology-Enhanced Learning Environments.*** Innovation and learning are key markers of the organizational culture of districts that have embraced a deep learning agenda. District-wide developments in OCSB included:
  - the design and intentional creation of powerful learning environments ranging from the substitution of old-fashioned and

underused school libraries for open, flexible learning commons where students and adults alike can access information on mobile devices and on printed format, work individually or in small groups, and have multiple and flexible options to work comfortably, to the development of architectural design of entire school buildings created around a specific pedagogical vision captured by deep learning;

- significant investments in technology with deliberate strategies to shift the focus from technology use per se to pedagogy and deep learning; and
  - policies whereby adults are expected and supported to model proper use of technology and social media.
- **Intentionally Developing Coherence, Capacity, and Leadership for Deep Learning across the system.** This involved actions such as:
    - creating an interdepartmental leadership structure that meets at regular intervals to create a shared focus, language and culture centered around deep learning, to review what's happening in each department, establish connections, and identify and fill up gaps; and
    - leveraging existing structures to facilitate the spread of deep learning system-wide, recognizing the good things already happening, and magnifying the interconnections between deep learning and system documents (e.g., frameworks of school effectiveness, subject area curricula, etc.).
  - ***Establishing a culture of collaborative inquiry and innovation for deep learning system-wide.*** In OCSB system leaders act as 'lead learners' that create the conditions for everyone to learn deeply while learning alongside them about what works and what doesn't, and modeling an inquiry approach to learning. They create and capitalize on opportunities for collaborative inquiry whereby educators and leaders alike engage in joint work to examine, try out, test, and continuously refine their pedagogical practice. Key to establishing a culture of innovation is creating an environment where everyone feels safe to take risks and depart from conventional practice. Explicitly encouraging actors across the system to do things differently, fail, learn from failure, and get better as a result is a simple yet powerful tactic. Finally, in

OCSB and other districts that have fully embraced a deep learning agenda, leadership and power are distributed and remarkably flat, with schools having direct access to the central office and system leaders deliberately interacting with system actors through learning partnerships, dialogue, and open communication.

### **Vignette C: How to Mobilize Deep Learning System-wide. \*\***

Relentless Focus and Consistent Messaging on Deep Learning. The Director of Education and the Associate Director of Education at the Ottawa Catholic School Board are involved in the system-wide deep learning agenda as equal partners. They deliver consistent messaging about the priority of deep learning across the entire system, including the school board of trustees. The starting point is the use of deep learning language in the first year as a minimum base expectation. Part of the consistent messaging is about framing deep learning not as a stand-alone initiative, but rather a lens through which to critically examine and improve pedagogical approaches to improve student achievement.

Placing deep learning at the center of the district agenda at OCSB has also led the board and senior administrators to take a thorough and honest look at existing initiatives, let go of those not aligned with deep learning (popular as they might be), to re-allocate the resources from those initiatives toward the deep learning agenda, and to thoughtfully select or design any new initiatives so that they connect and support the adoption and widespread dissemination of deep learning.

Constant Communication and Collaboration on Deep Learning Across the System. OCSB has established multiple channels for lateral and vertical communication and collaboration for deep learning. At the top of the system, senior administrators themselves are expected to and have developed a deep understanding of deep learning (an expectation that serves as an explicit criterion to select new senior administrators or let go of those who demonstrate weak or no commitment to deep learning). Senior administrators work with and feed off of each other, each contributing to the articulation of deep learning in OCSB as momentum grows within the board. A Deep Learning committee has been created as an interdepartmental leadership structure that meets regularly to communicate progress and engage in joint work around the deep learning agenda – recognizing and dealing with what’s getting in the way of deep

learning, and identifying and strengthening the strategies and conditions that enhance it. This committee includes union representatives to help maintain open lines of communication and collaboratively address workload concerns associated with adopting deep learning in classrooms and schools. (Among the strongest institutional constraints for deep learning identified across the board in Ottawa Catholic is the provincial report card, perceived as clearly disconnected from deep learning – the board hasn't yet come up with a way to go around or modify its format and content).

Superintendents, in turn, are in close contact with their school principals, constantly supporting the learning needs of everyone in the school - that is, the learning needs of various groups of students as well as faculty and principals themselves. Learning walks have been established as a regular practice whereby a small number of senior administrators and school principals visit schools to observe classroom practice, develop the skill to describe it, examine it, and provide actionable feedback to the teacher whose practice was observed.

The board also organizes multiple venues and opportunities for bringing people together at various points in time in a variety of network configurations based on the learning needs of educators and school leaders. Over time a common language and a shared understanding of key principles of learning have become embedded into all learning networks within the board.

Development and Use of Tools and Environments to Support Deep Learning. Easy-to-use support materials that indicate progress points of implementation (e.g., flipcharts, slide decks) have been developed and tailored in-house based on materials generated through the NPDL global network. The new tools created at OCSB highlight the compatibility between deep learning and Ministry expectations thereby dealing with any concerns that may have arisen due to perceived differences in the direction of the province vis-à-vis the actions of the board.

Developmental Approach to Adoption of Deep Learning. The initial approach to introduce deep learning in OCSB was to invite teachers and school leaders who were already interested and ready to move in the deep learning direction. The district chose to have at least one school from each region of the school board involved in deep learning, thus creating conditions for its later spread across the entire system. OCSB makes

opportunities available for educators to learn and grow on their deep learning journey regardless of their starting point. At the same time, there is a system-wide expectation that all educators and school leaders would develop familiarity with and use the language of deep learning. In addition to the professional learning networks that educators and school leaders have access to at OCSB, the district now has a number of schools as well as deep learning certified teachers as additional 'assets' to capitalize on to develop the capacity of other schools and teachers to bring deep learning to life in more classrooms and schools.

\*\* The ideas presented in this Vignette represent provisional and preliminary findings from a case study currently under development about the Ottawa Catholic School Board.

## Changes at the local level in perspective

There are several tentative conclusions we can make about deep learning at the local level. The main one is that it represents a comprehensive and radical change in the culture of learning and schooling. It immediately calls into question normal routines, behaviors and values relative to conventional schooling. The way we would cast it at this stage is in terms of what deep learning has going for it, and what does it have going against it. We don't pose this question in terms of theoretical arguments but rather in relation to *forces for and against the likelihood of transformative change on scale*. In fact, these forces represent the work we are now doing on an international scale. We portray these factors as follows:

### Forces Against

- Outside the Comfort Zone
- Complex
- Unclear
- Difficult to Assess
- Bigger system

### Forces For

- Exciting
- Passion and Purpose
- Collective
- Speed of change
- Societal disruption

On the one hand, deep learning generates a great deal of discomfort and ambiguity—what is it, how does it work, is it any good? At the same time, it is



complex, not the least because it requires fundamentally different role relationships between and among all key players. Not only are you unclear, but so is everyone else. It is also difficult to assess in terms of progress. It raises questions in nearly all respects. Moreover, the bigger system—the macro system—is likely to be less committed or positioned to support classroom level change.

On the other hand, we have already seen that there are a host of factors that favor deep learning. There is a constellation of motivational factors fundamental to the human condition: irresistibly engaging learning, personalization linked to doing good for society, working with others on a common cause, creating something new, and the like. On the big picture side, there are inevitable forces of devolution, connectivity, aggregation, and acceleration that make network learning inescapable and rapid. The only variable is will it represent 'good learning'.

Whether these conditions will result in radical breakthroughs remains to be seen. We do think that our newest work in identifying the 'equity hypothesis' (deep learning is good for all but especially good for those who are traditionally underserved) augurs well for a system-wide take-up of deep learning. We are now amassing case vignettes of students in all categories of disadvantage, who were floundering or dropping out of conventional schooling, but who are now experiencing the opposite with deep learning – they are flourishing and in many cases doing better than their more advantaged counterparts who have not experienced deep learning (Fullan & Gallagher, 2017). This brings us to the macro scene.

## Chapter Four: Macro-Level Change

Macro-level concerns the state or society as a whole. It encompasses the formal system – governments, official agencies – but also involves business, interest groups, foundations, advocacy groups, post-secondary institutions, digital behemoths, and scores of entrepreneurial startups and small enterprises. For the purposes of this white paper, we will stick as close as we can to the formal and informal education systems. If we have an overarching value it is that deep learning is an essential and necessary public good.

There is no jurisdiction that we know of that has created the super-structure to support deep learning across a whole provincial, state, or national system. What we can do, however, is to identify the components at the macro level that will need to be addressed and in place, and to indicate what state jurisdictions will need to do to stimulate and ‘manage’ the evolution of deep learning. The most obvious elements include: digital infrastructure, policy, investment and support strategies, and assessment systems.

High speed, ubiquitous digital access for all is an obvious requirement. Market forces have been moving in this direction anyways, and governments must ensure that the democratization of high quality access and devices becomes complete and continuously updated.

Policies and investment strategies related to deep learning implementation and evolution need to be in place. Policies must explicitly embrace equity of outcomes (no subgroup should perform at a lower level than any other subgroup). Some initial evidence suggests that students in schools that intentionally pursue a deep learning agenda fare better than their counterparts in conventional schools on measures of achievement and engagement (see Zeiser et al, 2014; Huberman et al, 2014; Bitter et al, 2014).<sup>1</sup> But more specifically related to equity, evidence is emerging that suggests that deep learning is a strategy that especially helps the

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<sup>1</sup> A three-year study conducted by the American Institutes for Research (AIR) examined teaching practices, support structures and student outcomes at 19 high schools belonging to 10 school networks with a “mature and at least moderately well-implemented approach to promoting deeper learning” (Huberman et al, 2014: 3,4, in Heller & Wolfe, 2015) to assess how students performed when schools explicitly set out to simultaneously teach sophisticated intellectual content along with interpersonal and intrapersonal skills. The three reports resulting from the study (Zeiser et al, 2014; Huberman et al, 2014; Bitter et al, 2014) concluded that “students who attended the self-identified “deeper learning” schools were more likely to finish high school on time, went on to four-year colleges in greater numbers, got higher scores on state achievement tests, did better on assessments of problem solving, and rated themselves higher on measures of engagement, motivation, and self-efficacy.” (Heller & Wolfe, 2015: 3).

those most disconnected from conventional schooling, simultaneously enhancing quality and equity in educational outcomes. As reported by Noguera, Darling-Hammond, and Friedlaender (2015); 'schools that engage low-income and minority students in deeper learning have stronger academic outcomes, better attendance and student behavior, lower dropout rates, higher graduation rates, and higher rates of college attendance and perseverance than comparison schools serving similar students.' 'Attack equity with excellence and all else will be covered' would be the tweet. We don't claim that 'equality of outcomes' in terms of group averages will be obtained in the short run, but we do believe that moving as close as possible to that goal is the standard that deep learning advocates should set for their work.

Similarly, state curriculum policies must embrace deep learning experiences and outcomes as official policies. Indeed, this is what is happening in places like British Columbia, New Zealand, Victoria, Australia, Finland, Ontario, and Singapore to name a few. The problem is that these policies state the new thinking goals and global competencies as aspirations, but do not focus much on how to get there. The latter is where investment strategies come into play. The state must legitimize, support and enable schools and districts to engage and embrace deep learning. They must invest in innovations related to deep learning, and strategies that enable the field and the center to constantly learn from what is being tried out. The center should also legitimize cross-boundary partnership and learning – networks of schools and districts, business-school partnerships, partnerships with non-profits and other advocacy groups, and global engagements. Our NPDL slogan (which emerged from the work) is: *Engage the world, change the world*. Make no mistake about it: deep learning and deep system change are a mutual feed; you cannot have one without the other.

Part of this revamping of public policy must address the perennial bugbear: how should assessment be positioned? In addition to the fundamental need to develop new, reliable measures of deep learning, as well as effective methods to capture and assess deep learning skills (individual and collective) as they become manifest in the everyday work of students, the solution, broadly speaking needs to focus on both internal and external accountability. Internal accountability refers to the development of collective responsibility for student learning among teachers and school leaders. Individuals and groups define the learning goals (relative to state policy), seamlessly link learning and assessment, and are transparent and specific about what is happening and with what impact. External accountability reinforces, and only in select cases intervenes, with respect to performance related to new measures. The assessment system focuses on progress related to reducing inequity as well as attainment (see Fullan, Rincón-Gallardo, & Hargreaves, 2015).

Another facet of the overall solution concerns the re-development of the teaching profession. In order to effectively advance a deep learning agenda system-wide, the role of teacher has to be radically repositioned from one of authority and control to one of shared leadership and co-learning; from one of getting students to learn how to be taught to one of getting students to learn how to learn on their own; from serving as role models of knowing to role models of learning (see for example Lampert, 2015; Richardson, 2015). Hargreaves and Fullan have written about why this needs to happen and how it can be done in detail under the banner of 'professional capital' (Hargreaves & Fullan, 2012; Fullan & Hargreaves, 2016). It is very clear that 'collaborative professionalism' (where teachers have degrees of autonomy and teamwork) is crucial to the solution, and that this very collaboration has to liberate students to be change agents with and without teachers as active partners.

As we said, we know of no system that has developed the macro level in a way that stimulates, supports and holds to account all levels of the system in relation to deep learning. In the next phase, we need examples of systems that have consciously worked to remove barriers, and incentivize schools through such actions as endorsing broader forms of assessment and reporting, actively providing professional learning, taking a policy stance on the curriculum and the importance of deep learning within it, entering into partnerships and so on. As part of NPDL, we have started to do this through the development of case studies that document how jurisdictions such as some school boards in Ontario are deliberately adopting a deep learning agenda, identifying and removing barriers to its adoption and dissemination, and strategizing to spread deep learning system wide.

In short, we need proactive examples of systems that commit to leading the way. Stated differently, systems need to catch up to and leverage the most advanced parts of their jurisdictions that are already ahead of the game.

## Chapter Five: Future Scenarios and Recommendations

Deep learning, we have argued, has come to the fore in educational thinking in recent years. But what lies beyond getting started? What is the longer-term scenario? These are tougher questions because we can't say for sure, but we strongly suspect that it will involve radical changes in how we think about the very nature of schooling, which has in its basic structures remained largely unchanged for so long that it is hard for us to imagine learning without schools, without a teacher up front responsible for an age-related class of students, without books, defined learning outcomes, paper-and-pencil tests, etc.

Deep learning is about applying knowledge creatively, making new connections and finding ways to solve problems. Whereas much learning is passive, deep learning is more active and indeed more akin to satisfying work. You can't memorize it (at the end, when it's deep learning you *do end up* memorizing it, but committing it to memory is a by-product of engaging deeply with it, rather than the main process of 'learning'), you have to do it, and sitting at a desk is rarely where this happens. Deep learners *retain* more of what they learn because it becomes embedded in their psyches (this is what is known as long-term memory).

We cited earlier Jal Mehta's 10 Ways to Die with Deep Learning. By contrast, we offer from our worldwide experience in Deep Learning over the past three years 10 Ways to Make Deep Learning Live (or 'what is deep about deep learning').

1. Learning that goes from simple to complex ideas.
2. Learning that is simultaneously personal and collective.
3. Learning that changes relationships, and pedagogy.
4. Learning that sticks in long-term memory.
5. Learning that involves a critical mass of others.
6. Learning built on innovation relative to key problems/issues.
7. Learning that attacks inequity to get excellence for all.
8. Learning that engages the world to change the world.
9. Learning that creates citizens of tomorrow today.
10. Learning where younger people make older people better.

Deep learning is symptomatic of an even broader transformation and something that will unfold as we progress, guided by strong core values about the purpose of education and of learning (moral purpose as our guiding star). We can also point to the early indications that this can and indeed is happening.

In this paper we have tried to be realistic about the considerable barriers faced in relation to the prospects of deep learning taking hold system wide. In the face of this we also have argued that the forces for upending the status quo are formidable, because they are emerging at the grass and middle roots, potentially *en masse*. These are the marks of social movements. System leaders have a choice: help enable it, get out of the way, or be swept aside. Education may yet come into its own: at the core of the evolution of humankind.

## Recommendations

At a general level we have eight observations arising from this paper. We then conclude with action recommendations for four sets of groups.

1. Realize that the status quo is seriously defective; assume that it should be upended.
2. Approach deep learning as a set of conditions that must be addressed in concert. Use the 10 Ways to Make Deep Learning Live as an action check list.
3. Treat deep learning as a system change that will require changes at local as well as macro levels. It is okay to start somewhere but know that it must be leveraged up, down and sideways.
4. Create and/or join a group that is committed to pursuing deep learning. Treat this as a developmental learning journey.
5. Have fundamental goals such as the 6Cs, and connect them to a learning pedagogy making sure that both 'belonging relationships' and 'engaging pedagogy' are addressed and integrated.
6. Commit to the power of deep learning as a proposition to engage the world for the purpose of changing yourself and the world.
7. Whatever you do, attack inequity with excellence in order to get more basic change.
8. Take into account the whole system. Whatever level you are at, take risks based on: i) helping those below focus on deep learning as you establish conditions for liberating them; and ii) viewing those above you as leaders who should like but not control what you are doing.

### 1. Systems

It is recommended that systems review and adjust macro level settings to promote deep learning in schools, including ensuring that:

- policies and investment strategies are in place to support a system-wide commitment to deep learning;
- the curriculum gives explicit attention to those competencies (or 21<sup>st</sup> century skills) that are the key outcomes of deep learning and that content is restricted to big ideas and key skills;
- as far as practicable, these outcomes of deep learning are recognised and given prominence in assessment and reporting arrangements and in the use of assessment information for accountability purposes;
- system-level teacher preparation and development programs give specific attention to developing teachers' pedagogical skills with respect to implementing deep learning; and
- processes and structures are in place to promote, monitor and evaluate the implementation of deep learning, to address barriers that may arise and to promote collaboration across the system.

## 2. Districts

- establish a clear and actionable vision for deep learning and place it at the center of the district's agenda;
- create multiple opportunities for students and adults to observe powerful pedagogies for deep learning, try them out in their own classrooms, and get ongoing support and feedback from trusted colleagues or mentors; and
- nurture a culture of innovation where adults and students alike feel safe to try new things out, fail, learn from failure, and get better as a result.

## 3. Schools

It is recommended that schools plan and implement action to promote deep learning including:

- making deep learning a key priority in the school's improvement plan;
- giving positive recognition to teachers who demonstrate a willingness to adopt new pedagogies, roles, routines and relationships in the context of pursuing deep learning;
- creating professional learning teams and providing coaches with release time in order to support teachers as they seek to further refine deep learning instructional strategies;
- addressing potential barriers to deep learning including the school timetable and resource issues;

- seeking wider understanding of and engagement of parents and the wider community in making deep learning something that extends beyond the school; and
- monitoring the outcomes of implementing deep learning, especially its impact on different groups of students, and seeking to ensure that its potential to bring about greater equity is maximised.

## 4. Funding bodies

It is recommended that funding bodies increasingly seek to direct funds to projects aimed at:

- assessing the degree of penetration and deep learning in schools and systematic analysis of barriers and ways of overcoming them;
- collecting and disseminating quality examples of deep learning in action across different years of schooling and that span different subject areas, with accompanying commentary; and
- developing tools and instruments to generate quality formative and summative assessments of the outcomes of deep learning.

It is recommended that educational publishers work with educators in the field to develop new resources for both teachers and students to support deep learning in classrooms.

## 5. Educational researchers

It is recommended that educational researchers turn their attention to addressing those areas where there is currently little evidence (for example the potential of deep learning to narrow achievement gaps) or where there is a need for further research and development (such as in assessing students' acquisition of a range of higher-order cognitive and intra- and inter- competencies as they engage in deep learning).



## Conclusion

Our overall conclusion is twofold: one concerns barriers to deep learning, and the other the need for coordinated action that explicitly conceptualizes the solution as a *system phenomenon*.

### Barriers

Perhaps the largest obstacle pertains to getting started. Because deep learning disrupts the status quo, and because it represents a substantial departure from existing practice all the normal fears of loss and the unknown apply. What new skills and knowledge may be required, can I manage them, will it be successful, and indeed how does one measure success in the deep learning domain? At the same time, there will be questions and degrees of opposition from others: teachers, parents, administrators, policy makers and others. The first requirement is that there will need to be a group willing to explore the new possibilities. In our cases we have parts of schools and districts willing to seriously try the new approaches—sometimes with endorsement of other leaders in the system willing to be supportive. All you need is a small group willing to take the first steps.

### System-oriented strategies

The barriers we just portrayed occur with almost any changes that depart from the status quo. What is different about deep learning? With respect to small-scale examples (one or a few schools) there is not much that sets it apart. What does make it different is its inevitable requirement for *whole system change and its sustainability*. This necessitates a particular kind of getting started. Let's take the district and its schools as the unit. For system change the start must attend to both micro and macro issues. Within the micro level (schools and communities) a certain amount of joint consideration is required to ascertain that there is sufficient interest for at least a small number of schools to start the journey. In the case of Ottawa the beginning was structured around a cross-section of seven schools. The plan was for a rapid expansion over a three-year period to include all 84 schools in the district, which is what happened. In another paper we observed that this strategy is akin to 'an intentional social movement'—as distinct from a strategy that is often called 'going to scale'. For a variety of reasons pilot projects never end up expanding to scale (Fullan & Gallagher, 2017).

The first half of the system-change strategy, so to speak, occurs at the grass roots level—what we have labeled the micro level. At the same time, districts interested in system change must attend to the macro policy level. Sometimes these

conditions may be unfavorable (for example, a particular testing regime). The good news is that we are finding that state policies are increasingly favorable to the deep learning agenda. Recent curricular policies, for example in British Columbia, Finland, New Zealand, Ontario and California to name just a few, are congruent with the directions that we have taken up in this paper. We don't mean that there is an easy and automatic fit, but rather that districts interested in deep learning and willing to take a proactive stance towards state policies will find compatible areas of agreement.

The example we just offered was from the district perspective looking outward and upward. We could also take up the perspective of a state viewing its districts, but this would take us into another analysis. Our point about system change is that one way or the other you have to end up (sooner than later) engaging both the micro and macro levels in order to have any change of achieving system transformation.

No matter how you cut it, the time has come for concerted action. The status quo is not working, and new ideas are emerging that show signs of being deeply engaging for students, teachers and families. We also see that some policy makers and international bodies, such as OECD, are also taking up the deep learning agenda for many of the reasons that leading educators are. For all of us we say, treat this as a learning journey with enormous potential. From our work in deep learning over the past five years we have seen a 'start slow, go fast' phenomenon. What you can expect is initial doubt, elements of wonderment, halting steps, and pockets of success. With good leadership, and a degree of patience, we have seen time and again a burst of development as groups and sub-groups of educators and students become more comfortable with the new way, and experience breakthroughs of insights, personal meaning and collective enterprise. Deep learning by definition stokes intrinsic motivators: personalization, identity, mastery, creativity, and connectedness with others engaged in similar learning.

Most of all deep learning is becoming a worldwide movement, so there will be plenty of kindred spirits. At the same time, we acknowledge that there will be no shortage of doubters, so you will need the capacity to learn from those who criticize as much as those who seem to be on the same wavelength. The fact is that it will not be a simple or smooth journey, but the scores of educators that are currently involved in this movement tell us that it is worth it. And a big factor for many is that the thought of the status quo prevailing is itself enough of a motivator to consider alternatives. We do see more common ground for those working at what we have called the macro and the micro levels.

Deep learning is transformational. The status quo has never been more vulnerable because there is so much pent-up frustration and dissatisfaction with current modes of school learning. Moreover, more and more schools and systems are getting a direct taste, if not immersion, in new modes of engagement that take people to the deep end of what learning could become. These new modes tap into our very humanity, and into what the future might and could become. Deep learning gives every reason to join a movement that could be both personally and collectively fulfilling. The next 3-5 years will be crucial in sustaining the momentum. Our bottom line message is that this is not the time to be a bystander.

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