

Transforming Systems, Deep Learning and the Equity Hypothesis

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Achieving both excellence and equity in education systems has been a long held aspiration, but little progress has been evident. We maintain that the problem is poorly conceptualized, and correspondingly the strategy base for addressing equity and excellence simultaneously is exceedingly weak. In this paper we bring together two powerful concepts that we have been working on—transforming whole systems, and deep learning. We will arrive at the startling conclusion that deep learning pursued across whole systems could and should function to achieve both excellence and equity of outcomes. We call the latter ‘the equity hypothesis’. Our dramatic conclusion is this: attacking equity with excellence should become the education imperative that informs a healthier, safer, more just and prosperous global society.

Excellence and deep learning are closely related. We will delve into the meaning of deep learning later, but for now we refer to our basic definition of deep learning: “the process of acquiring the 6 global competencies also known as the 6Cs” (character, citizenship, collaboration, communication, creativity, and critical thinking”, Fullan, Quinn, & McEachen, forthcoming). Further, 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 personalized;
- is challenging and manifestly worthwhile;

- in some way is designed to 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.” (Fullan, Hill & Rincon-Gallardo, 2017, p. 7).

Deep learning has been receiving increasing attention over the past five years thanks to the Hewlett Foundation and others. On the one hand, there is little evidence that deep learning is taking hold in schools. Metha & Fine (2015) found very few examples of deep learning in secondary schools, even though they handpicked schools to visit that were nominated as examples of deep learning in action.

On the other hand, we see signs of a new movement that could spread rapidly as more teachers and students supported by leading administrators experience the value and excitement of deep learning. We are involved in this deep learning work in seven countries in over 1200 schools: Australia, Canada, Finland, Netherlands, New Zealand, Uruguay, and the U.S. We will also argue that global conditions are shifting in a way that favors and even demands deep learning responses.

We pursue these developments in two parts. First, because very little is known about ‘whole system change’ we use the province of Ontario as an example of intentional system wide transformation. We will see elements of equity and deep learning, but they are not fully developed yet in the Ontario case. However, the system transformation in Ontario, and corresponding professional capacity building, has enabled an environment in which deep

learning can be developed in large numbers of schools. In the second half of the paper we explicitly focus on deep learning and the equity hypothesis.

System-Wide Transformation

We (and our team) have been working on ‘whole system change’ since 2003 (provinces, states, countries). We start with Ontario largely because the province has been explicitly and successfully pursuing a whole system transformation strategy since 2003. Ontario has a population of 13.8 million people and is one of the most diverse states in North America. More than 27% of the population is born outside Canada (in Toronto the percentage is close to half), with almost 200 home languages other than English. Ontario currently receives more than 50% of immigrants to Canada. There are some 2 million students in 4800 schools (3,900 elementary, and 900 secondary schools), organized within 72 local school boards. Over 95% of the students attend publicly funded school boards. Twelve boards are francophone; and public as well as catholic boards are funded equally. In the next section we consider first the success that Ontario has had across the system, second the main strategies or factors that accounted for this success, and third how this transformation has prepared Ontario now to make advances further into deep learning.

Indicators of Success

In 2002 the Ontario system was flat lined or stagnant in terms of literacy and high school graduation rates, and had been since 1998. Here we give a brief account of what was accomplished in the 2003-2016 period, and more importantly *how* it was done. At the end we will take up the question of why ‘going to scale’ is the wrong metaphor, and that ‘intentional social movement’ is a more powerful strategy for the kind of deep cultural change we see in Ontario’s school system.

We begin with the results and then trace the causal features behind these outcomes. In the following three figures we show: the average results over time for literacy and numeracy for all students in grades 3 and 6 on the Ontario standard (figure 1); the results for Grade 6 writing (figure 2); and the graduation rates for all 900 secondary schools (figure 3).

Figure 1: Elementary Outcomes: Achievement Results (Grades 3 and 6 combined) for Literacy and Numeracy

Elementary Outcomes: Achievement Results

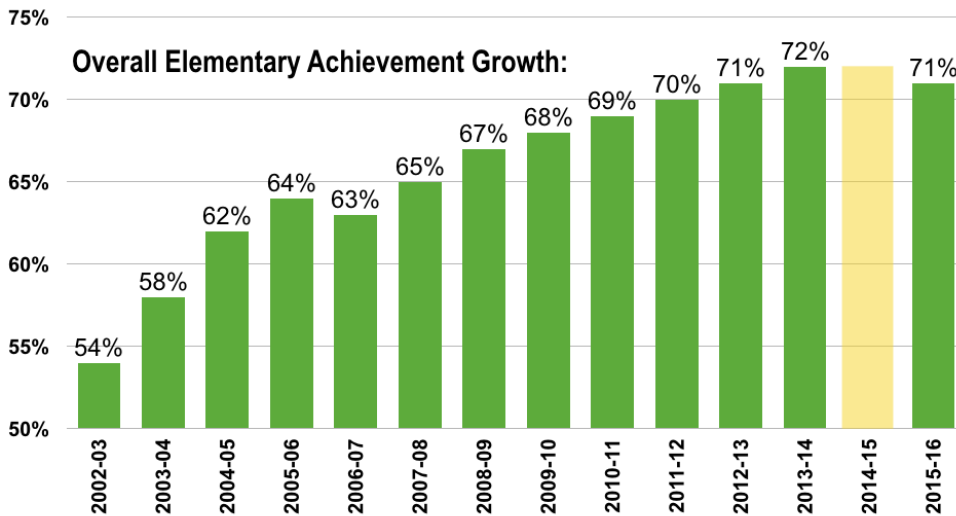


Figure 2: Mobilizing Data and Effective Practices

Mobilizing Data and Effective Practices

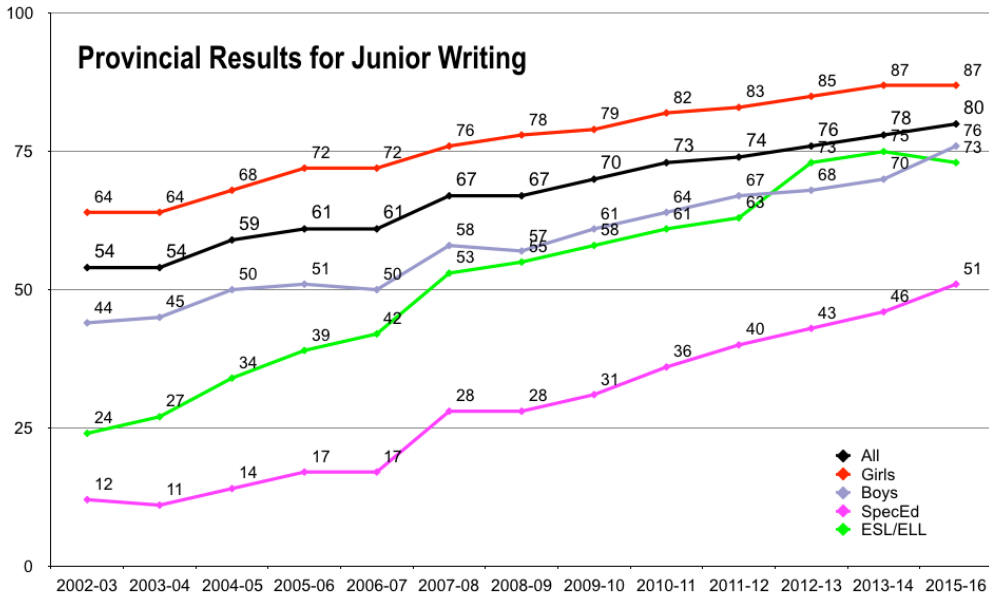
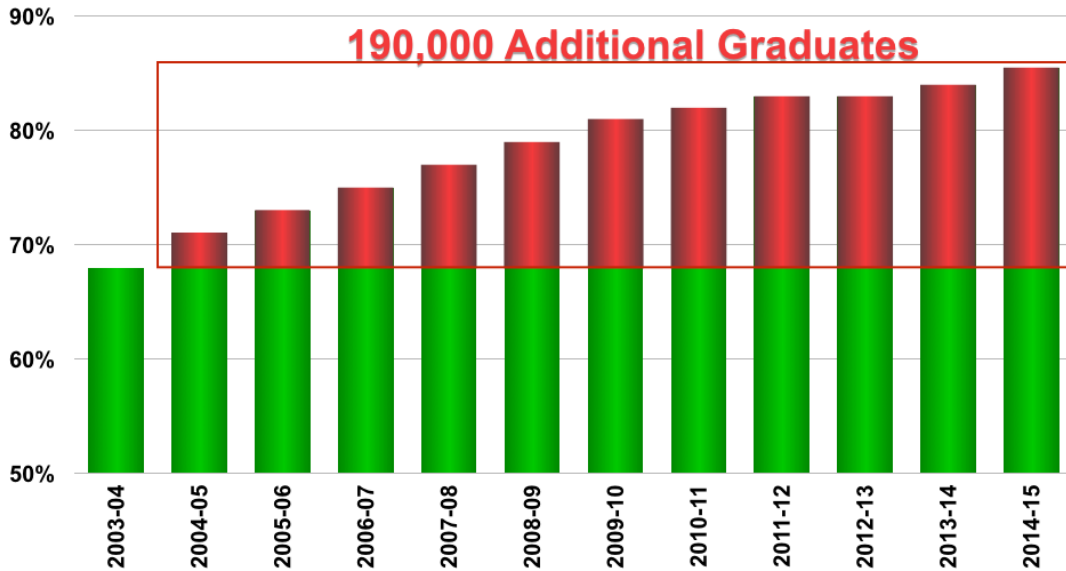


Figure 3: Provincial Graduation Rate—Additional Graduates

Provincial Graduation Rate



The elementary school measures are based on assessments by the Education Quality and Accountability Office/EQAO—the province’s independent assessment agency. Figure 2 shows that the gap has been lessening considerably across subgroups (e.g. for ESL students and students with special needs), but has not yet closed. High school graduation rates show a similar trend: step-by-step annual gains from 68% to the current 85.5% (figure 3). All three figures demonstrate considerable success in moving the whole system forward.

Another Ontario priority, ‘public confidence in the public school system’ has also increased as measured by surveys. Further, in Ontario’s turnaround school strategy (called OFIP: Ontario Focused Intervention Partnership) in 2004 there were 760 schools in the category of being stuck and needs improvement; by 2015 this number was down to 63 schools (more later about how this was accomplished).

Independent Canada-wide studies conducted by the Canada Council of Ministers of Education on literacy performance corroborate that Ontario has experienced steady growth. There have been at least three independent external case studies that have confirmed Ontario’s success: McKinsey, 2010, National Center for Education and the Economy, 2011, and OECD, 2011). And the recently released OECD PISA 2015 results show Canada (Alberta, British Columbia, Ontario and Quebec all score high) as one of five OECD countries showing both high performance and equity (OECD, 2016).

Incidentally, in reference to PISA 2015 the US showed some ‘movement’ in relation to equity (although starting from a low base). The reasons are not clear, but one could speculate that the focus on equity since 2002, combined with a good amount of collaborative professionalism operating under the radar is making a small difference, but we will contend in the last half of this paper than only deep learning as we conceive it will make a significant difference.

So, Ontario has achieved impressive system-wide results; but how do they measure up relative to deep learning? They certainly do not reflect the full-fledged deep learning that we take up in the second half of this paper. However, Ontario's reform was not a focus on basic skills and graduation. You cannot address reaching Ontario's literacy standards without engaging teachers and students in deep learning (although the term was not used at the time). Meeting the Ontario standard requires critical thinking skills and analysis, and the math challenges are not about basic arithmetic, they are about broader problem solving and analysis capacities (although improved deep learning in math has yet to occur). Finally, Ontario's measures are similar to PISA assessments that focus on application of knowledge—a measure of competencies that is closer to deep learning than many traditional tests.

Strategies for System-wide Success

It is impossible to 'prove' given factors contributed to Ontario's success because there are many interacting variables. But we believe that a plausible account can be made that explains overall trends. We know what doesn't work. Let's count the ways: punitive accountability, standards by themselves, compliance driven cultures, silver bullet fixes and programs, solutions based on a view of teachers that they cannot or will not change, systems in which teachers get little feedback or where the principal, however good, is the only source of feedback, absence of mechanisms for teachers, schools and districts to learn from each other, competition where there are only a few winners, and so on. We don't take up in this paper the development of the teaching profession, but see the analysis that we just completed for Learning Forward: 'Bringing the profession back in' (Fullan & Hargreaves, 2016, and Hargreaves and Fullan, 2012).

High achieving systems operate on a very different set of beliefs. They see teachers as respected professionals who balance autonomy and responsibility, engaged individually and collectively in pursuing improved teaching and learning on a continuous basis. These systems then set out to make this collective capacity a reality. We can identify at least 8 factors associated with fostering system success—a set of factors that intersect to support the development of a culture of focused collaborative professionalism. It is this mutually reinforcing re-culturing that establishes and sustains success across and within the overall system, while at the same time laying the groundwork for accelerated progress in deep learning. We will also conclude in this section that Ontario’s success was due to what we have later labeled an *Intentional Social Movement* strategy based on changing the *culture* of the system, and will contrast this with the typical large scale strategy that has failed time and again, namely, *going to scale*. But first the explanation: the eight interrelated factors are:

1. A small number of ambitious goals (high standards and expectations) relentlessly pursued: literacy, numeracy, high school graduation, reduction of learning gaps among subgroups, increased public confidence. Along the way (2010) Ontario also established full-day kindergarten for all 4 and 5 year olds. Increasingly the province acted on anti-racism, anti-bullying, and announced in 2014 announced that ‘equity, excellence, wellbeing, and public confidence’ were the official set of priorities (see our discussion below with respect to the relationship among equity, excellence and well being).
2. A focus on leadership and capacity building related to effective pedagogy that included developing school principals as lead learners, School Effectiveness and Student Success Leads at the district level, and Student Success Teachers (SST) at the secondary level.

3. Establishing a new unit within the Ministry of Education including the Literacy Numeracy Secretariat (LNS) and the Student Success branch whose staff consisted of a number of skilled practitioners who worked jointly with school districts to build their focus and capacity on the core goals.
4. Mobilizing data, and intervention in a non-punitive manner, reducing distractions, and establishing principles of trust, transparency and urgency thereby examining progress and designing related actions at every level of the system.
5. Strategic and transparent actions taken to engage every level of the system—building coherence at classroom, school district and provincial levels—including structures and professional resources (materials, time) to support staff analysis, planning and action informed by evidence in the form of data and current education research in response to each school’s needs. A heavy emphasis is placed on engaging pedagogies such as collaborative inquiry and its links to student engagement and achievement. New approaches are based on research, are monitored by researchers during and after implementation, and results are continuously shared with and by the field, modeling a cycle of research into action and action into research at every level of the system.
6. Using multiple overlapping strategies to learn from and within the system *during implementation*. These include focused provincial and regional meetings to share ideas about what works best in practice relative to each priority; funding a strategy called *Leading Student Achievement (LSA)* which is carried out by the three school principals associations (Miller, 2015); and developing another initiative named the *Teaching, Learning and Leadership Program (TLLP)*, funded by the government and organized by the teachers unions in which two or more teachers apply for funds to examine issues

of practice related to policy priorities and for which they report back to peer groups conducting other TLLP projects, and to the general field through conferences and professional publications (Campbell, Leiberan, & Yashkina 2015).

7. Throughout this we see the emergence of what we have come to call ‘leadership from the middle’ (LftM) in which districts develop greater intra-district capacity, inter-district networks of learning, and become better partners to schools, and upwards to the state (Hargreaves & Ainscow, 2015, and Fullan, 2016).
8. Investment of resources both in terms of the base budget, and in relation to targeted funding of strategies that addressed the needs of those doing less well in the system.

We must also take up at the outset the issues of racism, prejudice and hate as they relate to various sub-groups, and in turn to equity, excellence and wellbeing. A positive school climate and a safe learning and teaching environment are essential if students are to succeed in school. Bullying and racism are the antithesis of the relationships and environments needed for success, and so must be addressed within a student achievement strategy. Ontario, as part of its reform strategy, put in place a provincial policy on Bullying Prevention and Intervention. This policy outlined expectations for school boards on developing and implementing their bullying prevention and intervention policies. It was accompanied by funding which allowed districts to implement proactive measures, often developed and led by students, to teach empathy and reduce bullying in schools. In addition, school districts were asked to implement anti-racism programs, designed to protect students from direct or systemic racism, and also to teach what it means to be part of an inclusive society. While these programs were largely designed to be

proactive, they were also explicit about defining bullying and racism, and requiring monitoring and intervention.

In 2017 some forms of racism, hate crimes and malicious actions against minorities have become more evident. The province has maintained and then strengthened its policies and actions concerning the treatment and protection of minorities with the establishment of an Anti-Racism Secretariat that published a major 3-year anti-racism strategic plan (Ontario Ministry of Education, 2017).

Our view on the relation between racism, and other prejudices on the one hand, and student learning and prosperity is as follows:

1. Policies of zero-tolerance are required for actions that are unequivocally based on hate and intolerance whatever the minority group: race, sexual orientation (LGBTQ), Islamophobia.
9. Systemic racism, when people are not aware of, or do not admit to their own prejudice, requires action. The line between point one—overt hate—and point two—systemic prejudice is sometimes difficult to draw. In all cases policies and activities must also focus on teaching the values of diversity and understanding in proactive ways, not just punitive.
10. The evidence is compelling that even in seemingly fair societies minorities suffer prejudice on a daily basis (see Canadian Author, Shakil Choudry's (2015) treatment of Deep diversity. Other forms of racism may be baked into the culture as U.S. black writer Ta-Nehisi Coates (2015) writes in a passionate letter to his teenage son—after a lifetime of racism Coates concludes that it may be impossible to overcome 'white supremacy' in our lifetimes.

11. When it comes to solutions not all minorities are the same even within the same color group: Somali, Jamaican, and black students in the U.S south are very different from each other. A similar mix of prejudice and differences is documented by Canadian author Kamal Al-Solaylee (2016) in his worldwide tour as he writes about: Brown: What being brown in the world today means (to everyone). As with all students it follows that a more personalized approach is required.
12. Relative to points 1-4, anti-prejudice policies are essential but not sufficient to address our 'equity and excellence' hypothesis. In addition to directly stamping out prejudice and proactively teaching the value of diversity in our society, there must be strategies than enable all students to thrive in learning. Put another way, reducing or even illuminating ill being does not in itself increase wellbeing that includes possessing the 6 global competencies.
13. It follows from 5 that we need strategies and actions that build relationships with all students and their communities regardless of background, taking into account their contexts, and engaging them in relevant learning.

Our conclusion can be best expressed by the formula:

$$WB= f(Eq,Ex)$$

Wellbeing is a function of equity and excellence, where equity means both lack of prejudice, and equity of high level learning outcomes.

The focus is on physical, and mental health and personal safety combined with deep learning experiences and development. Excellence is found and cultivated everywhere, which

takes us to another fundamental premise: ‘hidden figures’ (a metaphor based on the movie of the same name where a group of behind the scenes black women with special math abilities played a critical part in saving the Apollo NASA space mission and building the space agency’s successful future). When it comes to the equity hypothesis, *every student is a hidden figure!*

Similarly, in the words of an Ontario First Nations leader: “In our culture we believe that every child is born with gifts...What will our schools do to uncover and develop the gifts of our children?” (quoted in Ontario Ministry of Education, 2014). Some students have much further to go if they are seriously disconnected from the world, and our ‘equity hypothesis’ will address this matter in the second half of the paper. We also contend that the world is becoming so complex to navigate that the majority of all students will need help in finding their place in the world, *no exceptions*. In this sense all students are to a certain extent ‘hidden figures’. As one example, Ontario found that 25% of students from middle class or higher had serious deficits as they entered kindergarten.

Learning is the centerpiece of the Ontario strategy for student achievement with a dynamic focus on improving pedagogy, and related learning experiences of all students. Throughout the reforms, large investments were made in building the capacity of teachers and principals to focus on improving teaching and learning: to be able to identify and analyze student needs, to set specific and measurable goals for improvement, to choose teaching strategies informed by evidence and research, and to work collaboratively to implement and monitor the changes in their classrooms. As staff experienced success and came to understand the power they had to change students’ lives, they began to see themselves as co-learners and action researchers for whom the improvement cycle became core to their professional practice – truly a social movement and deep culture shift.

In Ontario, such focused learning on the priorities is ubiquitous—in fact one could say ‘over determined’—as individuals will meet others working on similar priorities in more than one forum. This produces a phenomenon that foreign visitors have marveled at and that we have dubbed ‘the ability to talk the walk’. Educators across the Ontario system talk about priorities and solutions using similar language with great precision. Although not perfect there is great clarity and consistency across the province.

This transformation represents a culture shift in schools whereby teachers see themselves as a key part of the solution. More and more educators became the change agents, and so at the very least the overall change prepared districts and staff to take on the more challenging work of moving deep learning forward that we take up in the next section; it is this strong foundation in pedagogy and collaborative professionalism that has made the transition to deep learning work successful. The Ontario reform engaged educators in spreading the practices of collaborative inquiry and knowledge building throughout the province, as well as focusing teachers and principals on student need and thinking in order to engage students more deeply in learning.

We can perhaps best flesh out the strategy by contrasting it with failed attempts to go to scale. Two long-standing researchers in the U.S.—Professors Warren Simmons, and Pedro Noguera, who have focused on achieving success with minority students in poverty are cases in point. Professor Simmons (2017), who headed the 600 million dollar Annenberg Challenge (that is, lack of money was not the problem) reflected on Annenberg’s ten year experience at an international conference in January 2017. He reports on the overall findings in attempting to improve literacy and high school graduation for Black and Latino males. Simmons identifies some examples of success caused by, in his words: professional collaborative communities, good pedagogy, caring school cultures, focused leadership, and so on. In other words, he identifies

factors similar to the Ontario success. The problem he concludes was that they never got beyond small pockets of success. He laments the failure to ‘go to scale’, and declares this large-scale decade long endeavor as one of ‘promising practices, and unfinished business’.

Professor Pedro Noguera’s research over a similar period and across the U.S. involving various jurisdictions tells an identical story. In a new publication, *Taking deeper learning to scale* (2017), his basic conclusion is: “ For some time now it has been evident that the policies the US has pursued to elevate the academic performance of students, particularly those most economically disadvantaged, has not produced the results promised or hoped for”. He then cites a few examples of good results concluding that these are pockets of success that never go to scale. Indeed, as an alternative that might generate more success he cites the work in Ontario.

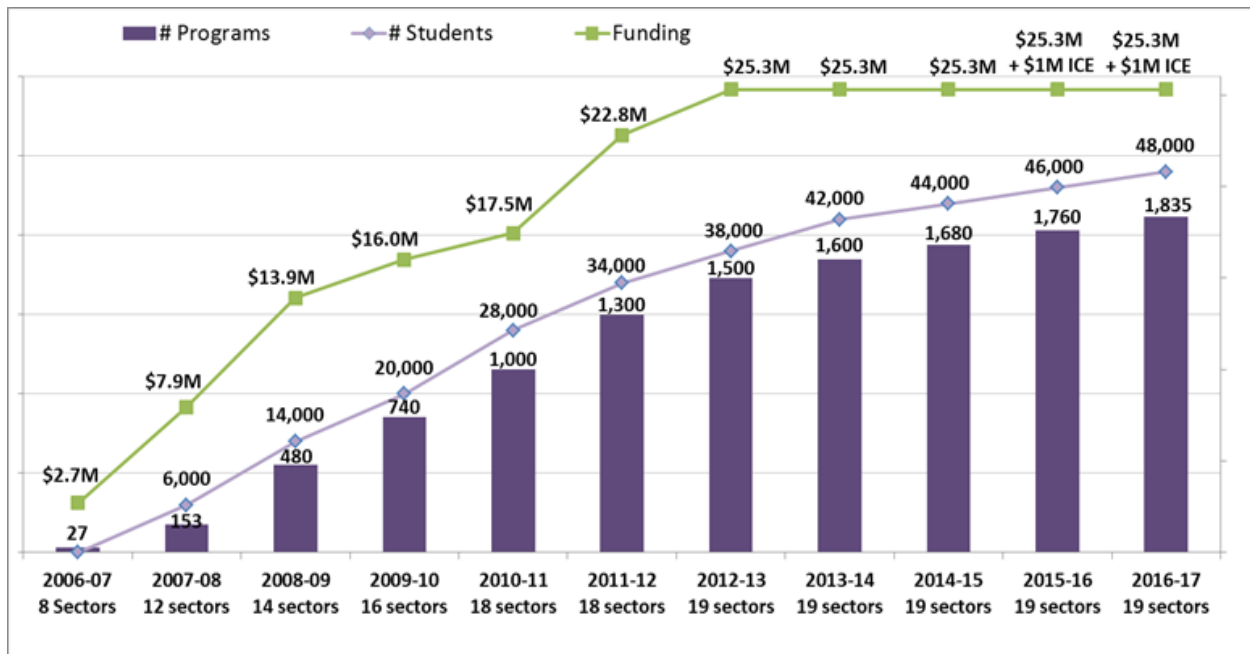
To be clear and specific, the difference between the Ontario success and that of Professors Simmons and Noguera is not about the direct factors associated with success, but rather about how to establish them across the whole system. We believe that ‘going to scale’ is the wrong metaphor. In such a strategy you establish examples of success, and then try to replicate them on a wide scale. This can never work because the new situations do not have the capacity for the work and take too long to develop it, and before long the strategy inevitably loses momentum. By contrast, working with the whole system from the beginning, as was the case in Ontario, building and spreading capacity from day one changes the *culture* of the system with mutually reinforcing strategies. This is what we call an *Intentional Social Movement* strategy because it is deliberate, and uses social development and positive contagion as the main vehicle for changing the system.

Let’s be more explicit in comparing going to scale with intentional social movement by examining an example that is closer to deep learning. One of the most dramatic innovations in

high schools in the U.S is High-Tech-High in San Diego, opened in 2000 with an enrolment of 450 students. The school is based on student choice and engagement in real-life problems, pursued by teams of students, guided by teachers but containing a great deal of student autonomy (rosenstock@hightechhigh.org). Learning is organized according to four basic principles: equity, personalization, authentic work, and collaborative design. It is by all measures a resounding success. As the success became known the demand increased around the question of ‘how to go to scale’. Now seventeen years later there are 13 high tech high campuses across the U.S. It has gone from serving about 450 students to some 6,000 students over this period. Compared to interest and need, it is a painfully slow spread of an excellent idea.

Compare the High-Tech-High Example to the development and spread of one of Ontario’s high school innovations, the ‘Specialist High Skills Major’ (SHSM) in Figure 4.

Figure 4: Specialist High Skills Major (SHSM), Ontario



SHSM is an innovation designed to reach students who want to focus on real life problems whereby they attend regular classes for at least half of the schedule, and do applied work in a particular sector in the other portion of time. It is like technical education except it is not restricted to technical areas only and it occurs across the regular school system—in almost all 900 schools providing relevant pathways to students pursuing programs designed to take them on to apprenticeship training, college programs, university or directly into the world of work after graduation. The programs vary according to the needs and interests of the community. To be approved and funded school districts must submit proposals, according to a framework and protocol. Examples of funded sectors are: aviation, finance, sports, manufacturing, health and wellbeing, and so on. Figure four shows the results: over a 10 year period steady expansion went from a base of 27 programs involving 600 students to its current size of serving 48,000 students and existing in virtually every one of its 900 schools. The additional cost is a modest \$25 million a year. The expansion of SHSM programs is one of the reasons why the secondary school graduation rate has continued to climb year after year for a decade.

In short, the comparison with High Tech High (which is admittedly a deeper innovation) is staggering: over a 10-year period 6,000 compared to 48,000 students. It will be recalled that 190,000 more students graduated from high school than would have been the case had the graduation rate remained at 68%. These are the differences comparing ‘going to scale’, and ‘intentional social movement’ strategies. To be clear, we deeply admire the High Tech High innovation. The question is how such powerful deep learning can spread to large numbers in a reasonably short period of time.

Taking Ontario’s system strategy as a whole, have we made the case that overall performance has improved while reducing inequity? Not quite. We need to examine more

precisely what Ontario did to reduce inequity. Second, when we say that the *system culture* has changed and it is this that gives it greater permanency and a better foundation for pursuing deep learning, what exactly does this mean?

Ontario's goal was to raise the bar and narrow the gap. It did very specific things that were aimed at closing the gap, which turned out to be precursors to more deliberate steps to what we call in the next section 'attacking inequity with excellence.' The so-called precursors consisted of paying attention to students who were not successful in the existing system, understanding their thinking, working with them and moving them toward success, defined as meeting provincial standards in literacy and numeracy in grades 3 and 6, and graduating from high school within five years.

The focus was changing the student's learning experience by improving teachers' ability to teach these students. The goal was to engage and assist teachers in every classroom in all 4800 schools in doing this, and to do this with a sense of urgency (for the sake of the students and to create momentum around reform). Compared to the present (where we now focus on specific groups of disconnected students, as well as individuals), the focus in the earlier reform was to help individual students in their classrooms whoever they were. The question was not about what new immigrant students needed, or indigenous students or other groups, it was about which students were not yet successful and what could be done to accelerate their learning. In the second half of the paper we will argue that strategies directed at the needs of specific groups based on their cultural and racial contexts are required in order to achieve both equity and excellence.

As the Ontario reform unfolded it became clear that considerable success was obtained with individual students who were disconnected, but there were also some groups or

circumstances whose needs required more explicit strategies – children in poverty, indigenous children and youth, new English language learners, children from certain ethnic groups, children with special needs, children and youth in the care of Children’s Aid Societies. This began a shift to addressing the equity needs of targeted groups of students not being served by the existing system. Focussing on specific strategies to help disconnected or otherwise poorly performing individuals and groups will form a strong basis of our ‘attack inequity’ argument in the second half of the paper, but let’s see here what some of the embryonic forms were that were undertaken by Ontario in the 2003-2013 period:

a) Reading Intervention

Long-term disconnection from school is often rooted in poor literacy skills. And so a commitment to have increased numbers of students reading at a high level and meeting provincial expectations in literacy is in itself an equity initiative. Every teacher had some students who were not making adequate progress in literacy and so every teacher could make good use of increased capacity in reaching these children. While schools and districts might have the funds to intervene with some of the most challenged students, these withdrawal and intervention programs were expensive and would never be able to serve all the students who needed help. To reach these students, teachers needed to gain skills that enabled them to become increasingly precise and responsive to their students’ needs and challenges. The most successful classrooms were those in which teachers understood deeply the stages a student went through as they learned to read well, could identify at what stage a student was having difficulty, had several high quality teaching strategies that they could apply to the problem. Teachers exercised professional judgement in choosing their strategy, and then observed and reflected on the level of

success so they could make appropriate refinements in their ongoing work with students. Thus, Ontario invested in professional learning such as:

- Engaging school districts in identifying their approach to the literacy problem. Districts dedicated more of their professional learning resources to the development of literacy at all grade levels. Some boards chose to provide DRA or other assessment training to all primary teachers. As results were monitored in the first few years, it was clear that this approach, coupled with other PD, was very successful, so results were shared with other districts.
- Engaging teacher unions and providing funds to enable them to provide PD in literacy for their members.
- Working with principal associations and providing funds to enable them to conduct administrator PD in the components of good literacy programs.
- Producing a wide range of resources focussed on literacy development and sharing these widely with the system, including research monographs sharing university faculty research summaries which were delivered to every school. Similar “What Works” monographs highlighting successful approaches yielding measurable results taking place in schools were distributed, as well as a number of videos featuring leading literacy experts discussing their approaches and showing Ontario classrooms and teachers who were implementing those strategies (all of these resources were sent to schools and posted online for free download).
- Sponsoring a series of literacy conferences and development opportunities for district and school staff, ensuring a mix of research to inform professional judgement and presentations involving Ontario educators sharing implementation.

b) Full-day Kindergarten for 4 and 5 Year Olds (FDK)

One of the most obvious places to start was to give all children a more successful beginning in kindergarten. Ontario already had half-day junior and senior kindergarten for four and five year olds so the government committed to expanding to full days, to be implemented over five years starting in 2010 (accomplished in three years). This involved some 250,000 additional children taken on even though the government had an 18 billion dollar deficit (see the discussion of resources at the end of this section).

c) Differentiated Summer Learning

Several years into the reform, to continue the year over year improvement in results, Ontario began to focus efforts on particular challenges. For example, research on the impact of summer vacation on children living in poverty was considered. Compared to their more wealthy peers who went on vacation, attended summer camps, and visited museums and zoos, all too often children in poverty do not have access to the same opportunities. While these children often learn at the same rate as others during the school year, over the summer the learning gap widens and so they fall further behind. In response to this, Ontario funded the superintendents' association (\$3 million per year increasing over time to \$9 million) to coordinate and support three week "summer day camps" offered by school districts in high poverty school areas for children in grades 1 to 3 – each camp was to be a combination of engaging literacy and numeracy activities and various craft and sports activities, not summer school but summer camp. Results were monitored and research completed, this resulted in the sharing of successes and challenges on an ongoing basis with the system to continuously improve the programs.

d) Secondary Schools

Ontario began by commissioning research to learn more about the students who dropped out and why. They examined research looking at the problem of students falling behind in secondary schools which identified the increased vulnerability of students who did not develop a strong connection to their school or experience success in their first year of high school. Ontario then used that research to design programs and interventions and provided funding and leadership to support the implementation of these approaches.

Such interventions included:

- Funding for an additional staff member in each of the 72 districts (called the Student Success Lead) to lead the implementation locally of programs to engage staff in keeping more students on track to graduate on time.
- Funding for an additional staff member in each secondary school (a Student Success teacher) to work with students, guidance staff and the principal to lead approaches to student success in the school, to coordinate programs and approaches to increase student progress to graduation in the school, to support an engaged and successful transition to high school by students identified in grades 7 and 8 as potentially at risk, to develop personal timetables for students at risk which scheduled some subjects they liked in their first semester of high school, and especially to provide a caring adult to make a connection to the school community for every student experiencing challenges to their success.

- Tracking of student credit accumulation to identify early and with greater reliability those students for whom interventions would be required, including a special focus on grade 9 students to ensure a successful transition to high school.
- Credit recovery and credit rescue programs designed to keep students moving successfully toward graduation, including external research into successful approaches and to ensure credit integrity.
- Research into which courses and subject areas presented the greatest difficulties and why, followed by curriculum adjustments and resource supports which allowed teachers to make the programs more interesting or relevant.
- The development of the Specialist High School Majors program to provide more engaging and relevant learning opportunities in career related fields.
- The development of a Dual Credit program for early completion of college courses for dropouts or students at high risk of dropping out.
- A re-engagement program in which schools and districts located the students who had dropped out and invited them back to school, providing supportive timetables in subjects of interest and mentoring when students did come back.

e) Indigenous Students

The Ministry of Education began to partner with members of indigenous communities and district school boards to encourage voluntary self-identification by these students in schools and to develop approaches to address the needs of these students. While some of this work is focussed deeply on the student achievement needs of this population and early progress is being

achieved, the overall strategy is much more comprehensive, involving federal and provincial governments and more than 133 separate First Nations, Metis and Inuit groups.

f) New Language Learners

Ontario has a large proportion of students (up to 25%) who begin school speaking neither English nor French (the two official languages of instruction). As the student achievement strategies were being developed, the approach in the province to new English language learners was being reviewed and revised. Curriculum documents and approaches were being updated to include the latest research in the field, and teacher professional development opportunities were sponsored by the Ministry of Education and continued by local school districts. Teachers worked in networks to support implementation of the changes and increased precision in their approaches, constantly monitoring and improving their practice.

g) Students With Special Needs

Throughout the student achievement reforms in Ontario work supporting these learners continued in schools. Many students with special needs benefitted greatly from teachers' increased capacity to teach with greater precision, assessing the challenges students faced, developing teaching strategies to address these challenges, and monitoring and constantly refining their approaches. The Ministry of Education released a document: Learning for All, and this was followed closely by Essential for Some, Good for All, a research and implementation project which provided significant impact for teachers and students. Ten school districts volunteered to work on building the capacity of teachers to more precisely differentiate their teaching to meet special education needs and challenges. Throughout the project Professor Andy

Hargreaves was engaged to help shape, monitor and document the work and the results. As the learning from that project with 10 of the 72 school districts was shared and more and more teachers learned from the approaches, the system began to regard precise teaching focussed on individual student learning successes and challenges as something that benefitted almost all students. The mantra of: “essential for some and good for all students” became a common approach, and the literacy results of boys, English language learners, and students with special needs all increased dramatically.

h) Children and Youth in Care (of Children’s Aid Societies)

Over the past four years, Ontario educators have begun to focus more specifically on the needs of this vulnerable group of students. School districts have been funded to support the development of innovative and varied attempts to improve learning with these students, strategic approaches are being monitored, and information is being shared. Early results are still quite varied, but there is a more precise focus and an increasing momentum developing around success for these young people.

Conclusion

We have gone into detail on the Ontario strategy in order to establish two fundamental points: 1) The basis of Ontario’s success lies in changing the *culture and capacity of the system*; and, 2) improving equity consisted of overall capacity building for staff as well as *targeted funded strategies* aimed at specific problems. As far as changing culture is concerned, the heart of the matter involves teachers, individually and collectively, learning how to work with diverse students, by building relationships, and establishing engaging pedagogy. Teachers engaged in

collaborative inquiry focussed on learning methods used with students, and seeking new methods, then testing and reflecting on results. Teachers enabled by school principals who act as lead learners foster these intra school cultures. In districts that are successful there are direct lines of engagement and connection on matters of pedagogy and progress between teachers, principals, program personnel, assistant superintendents, and superintendents. There is lots of lateral learning about what works across classrooms, schools, and districts, as well as vertical processing of ideas and outcomes up and down the line from the school to the Ministry of Education. This permeated learning culture is widely experienced and articulated (what we call ‘talk the walk’). The impact of these changes is demonstrated in the significantly improved student outcomes achieved in Ontario. What began as a series of program and pedagogical changes has become a broad shift in the culture of the school system. Once established it has the capacity to continue and to go on to bigger and better things, as we take up in the second half of this paper.

Now to money and its use. New money is essential for system transformation, but what really matters is *how the money is spent*. Ontario did two things. It increased the base budget in the first five years (2002-3 to 2007-8) from \$14.4 billion to \$18.1 billion respectively (an increase of 15% in real dollars adjusted for inflation). . And crucially it targeted money to high yield specific areas. Let’s call these gap-closing expenditures: \$250 million per year for operations and capital expenditures for full-day kindergarten (250,000 4 and 5 year olds), \$25 million for Specialist High Skill Majors, \$1.5 million for Ontario Focussed Intervention Program, \$6 million for School Improvement Teams, \$9 million for Summer Learning Programs, and so on. Here is the critical point: it is the *interaction effect* between investment in potential high yield strategies, and collaborative cultures that makes the difference. Cultures with capacity

know how to use resources; they just need and want more in order to tackle the most difficult problems. Cultures with low capacity are more likely to use new resources ineffectively, thereby squandering or undermining the potential impact. Cultures with low capacity need help to focus resources in order to develop new momentum.

The above developments in Ontario from 2003 to approximately 2012 set the table for system transformation and deep learning. We have seen hints of deep learning in the first phase. We have seen early and successful system-wide change, but not the more fully developed form that could be nurtured in an environment conducive to deep learning. It is our contention that the elements for system transformation, including drastically reducing inequity are emerging, and that this development feeds well into the broader deep learning movement in its search for both greater equity and excellence.

Deep Learning and the Equity Hypothesis in Whole Systems

Deep learning and ‘attacking inequity with excellence’ is an educational imperative critical to the future of global society. Inequality in income and education has become greater and greater in the OECD and other countries over the past twenty-five years. OECD recently reported that the richest 10% of the population in OECD countries earns more than 9 times than that of the remaining 90% (OECD, 2017). The consequence of this growing gap in resources and related education are destructive not only for the individuals but also for society in terms of the economy, innovation, social cohesion, safety, wellbeing, and indeed the future of the planet.

We have a bias for action and outcomes so our treatment here will be on what is happening in the domain of deep learning, and how we can accelerate and establish the work in the cultures of whole systems. We draw on some groundbreaking work in several fields, and on the global partnership we have established in seven countries with clusters of some 1200 schools and systems (www.npdl.global). What we are witnessing on the frontiers of these developments is potentially revolutionary.

The argument here is intricate but specific and we take it up in four subsections:

1. What are the global conditions in 2017 that require deep learning on a wide basis;
14. What do individual examples or vignettes look like;
15. What exactly is the equity hypothesis at work? What are the specific ways in which deep learning connects with the needs of individual students, especially those who are underserved;
16. What are the proof-points at this stage, and the corresponding policy and strategy implications for ‘attacking inequity with excellence’ for all?

1. Global Conditions are a Game Changer

- a. The world has changed and the skills provided by traditional schooling are no longer enough for living in 2017 and beyond. With global developments like Brexit, and the Trump presidency, the ‘big picture’ (where is the world going’) and the ‘small picture’ (where am I going’) are now on the same page. Everyone, including children, knows that something is afoot, that it could be dangerous for the future of humanity, and that leaders don’t know the solution even if they pretend to. The instability in the world is a much more palpable, real phenomenon. As we say, the big picture and the small picture are now on the same page. Anxiety is growing at a rapid pace. There is a sense of urgency without knowing what to do.
- b. Access to the world through social media, and digital sources, ideas, news (including false news), diversity, immediacy and more furnish a firestorm of relentless stimuli.
- c. New (as a set) global competencies are coming to the fore such as our 6Cs: character, citizenship, collaboration, communication, creativity, and critical thinking.
- d. New engaging pedagogies (actually a combination of good old pedagogies and good new ones) based on learning partnerships between and among students, teachers and families are rapidly developing, along with new ways of building relationships with students of different cultures and life circumstances.
- e. New knowledge and high yield forms of intervention are being discovered and developed (for example, from neuroscience, and from discovering the talents of those hitherto neglected; as we noted earlier we call this the ‘hidden figures’ phenomenon)..

- f. Top down stimulus (as was the case in Ontario, 2003) is being replaced by leadership from the middle (districts and principals), and leadership from the bottom (teachers and students).
- g. We detect a very strong ‘helping humanity’ theme among young people (from 4 years of age to 18) where doing something worthwhile is not seen as altruistic, but as basic to being human. The fit between deep learning (hands on learning and improvement) and making a contribution to society is fusing in many cases. Students are striving to become citizens of tomorrow today. Research in neuroscience is finding innate human qualities such as: wired to connect, wired to create and wired to help that can be enhanced or repressed by life and by schooling.
- h. Equity gaps between low and high performing students are becoming more pronounced in some countries with potentially devastating consequences for individuals and societies.
- i. Finally, effective leadership looks very different in 2017 than it has in the past decade. Leaders must learn and lead in equal measure; more co-learning and co-leading is required; leadership comes from all quarters and all ages (we all need to be experts and apprentices as Martin & Osberg (2016) put it).

All of these recent conditions present a new urgency, and a compelling opportunity as they contain the elements for a more rapid and dynamic response. This then is the backdrop to the question of how we achieve deep learning across whole systems. At this stage we do not have strong proof-points about widespread impact, but we believe that we can convey what is

happening, and point to compelling indicators that a potential revolution in learning may be underway.

2. Deep Learning Vignettes

We report here six specific examples from our NDPL schools that illustrate the particular fit of deep learning that radically changes the lives of those disadvantaged. Student A concerns a student with learning disabilities. Student B relates to the connection with a boy who was born blind. Student C is about a First Nations student who found his way against the odds, and became an agent of change for himself and his community. Vignette D is about a group of students who learned that the world and information therein can be very different depending on your country of origin. Student E is a grade 5 student who was identified at risk and who had low levels of engagement and progression in learning. Student F is a grade 1 student who stuttered, and who came to school with great anxiety and low self-esteem.

We could produce hundreds more of these snapshots, and there are indeed many individual examples in schools around the world. Our point is that these students are typical of what happens to disconnected students when deep learning is evident in the school as a whole. Our contention is that this can be done on a large scale if we put our minds to it (see point 4 below).

Student A.

Deep learning causes students to reframe questions, often changing their view of themselves in the process. Because deep learning is so different from the approaches of the past, it can be particularly effective in changing the world for students who struggle. Consider this example of a young man from southern Ontario as conveyed to us by a teacher:

He had struggled in previous grades and had developed a very negative attitude towards learning. On the first day of grade 6, his mother told me "he hated school and felt he was stupid". In past years, his low self-esteem and frustration had lead to behavior issues in class, and he had frequently ended up in the office after recess altercations.

When class started in September, he was not a risk-taker (not one to raise his hand or offer ideas), and seemed convinced he would fail if he tried. As we grew as a learning community in the classroom, he too seemed to grow. Learning went from being an isolating process to collaborative partnerships (classmates, teacher, families, community members, "experts") and common goals. When we tackled real-world problems that even the experts didn't have answers to, it put all of us on an equal playing field. I think for the first time, he felt he wasn't the only one who didn't have answers. Since there wasn't "one right answer", he started to offer some ideas of his own. He discovered that he often thought about things in a different way than his peers, which offered us a greater diversity of ideas and another perspective to consider. He was also full of questions, and he was happy to discover that questions helped focus our challenge and move our learning forward. When he realized learning was not about memorizing, it opened every door for him. He became one of—if not *the*—most active and enthusiastic participant in our room. Going deeper into real world problems meant every idea was a possibility, every point of view was being considered, and every piece of information was helpful. He became a student who spent some evenings hunting for information that would help us move forward, and he became a student arriving at the classroom door in the morning with a triumphant smile saying, "Listen to what I found out."

(Note: psych testing that year confirmed a significant LD and cognitive delays)

Student B.

Deep learning enables students to pursue new and unexpected questions as they arise, changing classroom dynamics in the process. This can provide particularly powerful opportunities for students with barriers to their learning and for those who share classrooms with them.

Born without sight, this student had no experience with the visual world. Since he'd been at our school since Kindergarten, the other students were familiar with his use of a cane, Braille, talking watch, etc. They were also aware of his impressive general knowledge and great mental math skills. But, when we began to dig into real world problems, the students reflected for the first time how a lack of sight would impact life outside of school—the students truly came to know, understand, and appreciate this student and his unique perspective. For example, when determining what criteria should be used to select the first colonists to settle on Mars, the class's thinking was pushed in a new direction when this student stated he would not make a good candidate because it would take him longer to do tasks—he would be too slow. Students argued that his knowledge of math and science, his quick thinking, problem-solving skills, etc. made him an excellent candidate. So, the discussion turned to "How could the instrument panels, transit vehicle, habitat interiors, be modified to maximize use by someone who could not see them?" The students began reflecting on our reliance on sight, what communities do to make things accessible for visually impaired people, and what more can be done. They were concerned that their classmate (and people like him) would be denied opportunities—in areas he could otherwise excel—because of his lack of sight.

It was when students started thinking outside the classroom walls that they fully appreciated the unique perspective and challenges their classmate faced in the real world.

Student C.

When students pursue deep learning in areas of relevance to their own lives, they not only improve in academic areas, but also frequently find their place and voice. For students from poverty backgrounds, this can be a life changing experience, as they begin to sense the power to direct their own lives and improve the lives of others. This is the case for the following First Nation student.

Sam was struggling in high school in Timmins, Ontario. Leaving his indigenous community and culture behind, as well as his grandmother with whom he lived, travelling hundreds of miles away to attend school in a community where many people expected First Nations youth to fail, boarding with a family he didn't know, he was beginning to understand why so many students from his village gave up and dropped out of school. A teacher engaged students in his class in a program called Students as Researchers sponsored by the Ontario government. Sam was academically behind others in his class, but wanted to take part as students got to work in a team to choose an area they would be interested in researching and improving. He talked to a few other students from his indigenous community and soon they had a group. Their research question: what are the experiences of indigenous youth when they transition to high school? They designed surveys and interview questions, and gathered their 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 indigenous 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.

And they knew what they needed to do. Sam and his group wanted to use their report to fuel a change and they became passionately committed to ensuring that young people from their community have a different experience. 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 indigenous youth a voice, and allowed the students to lead the changes needed in their school: indigenous mentors, peer tutoring, activities designed to celebrate indigenous cultural events and history for both indigenous and non-indigenous students and steps taken to change the host family experiences and connections to the community. What began as a project within a single course became a multi-year transition and action plan for indigenous students, and a shift in understanding within the entire school. Sam changed from a shy young man lacking literacy skills whom counselors recommended pursue courses in the applied track, to a confident young man who enjoyed reading and research, worked as a youth counselor at a Native Friendship Centre and aspired to a university program leading to a teaching certification.

Student D.

Deep learning can teach students to love challenges, to be resilient and to value their own learning journey. It can also give them greater empathy for others, and a more global orientation, which in turn gives them new perspectives on their own reality.

A grade seven class in a school in Toronto was pursuing inquiries about change in the community and world around them. The school itself is in an economically challenged area, with many families in public housing and a large proportion of new immigrants. One group of students (two who had lived in Toronto all their lives, and two recent arrivals from China) was looking at the movement of the tectonic plates and the forces that cause them to move. As they were researching their question, they decided to use two search engines, Google and Baidu (a Chinese search engine). They did this originally so that everyone in the group could participate and contribute, but soon discovered that the two search engines gave them access to more and different information, sometimes confirming each other, other times contradicting. This led the group into a discussion of why the information might be different on different search engines and in different languages, why and how one might validate information found on line, and ended with greater recognition of various international points of view.

Student E

Blair is a Year 5 student who was identified through numeric and non-numeric data as ‘at risk’ due to his low engagement and low progression in his learning. Along with five other students showing similar characteristics as learners, Blair was nominated for the school’s True Grit program. The aim of True Grit is to re-engage learners using the NPDL Character rubric as a critical tool, alongside the school’s Positive Education philosophy. Students participated in this ten week program for two hours each day, four days a week with the goal of the students re-engaging in their learning armed with the skills of grit, tenacity, perseverance, resilience and problem solving alongside improved self esteem and

confidence. Students developed a sense of belonging within the program – with some students commenting that they had never really belonged to a group before. Weekly volunteering in the local community through the Meals on Wheels program, and with the RSPCA, saw students communicating positively with adults and doing something worthwhile for others rather than focusing on themselves. Explicit teaching of oral language skills enabled students to better express their thoughts and feelings, and to do so in a positive respectful way. Mindfulness and developing a growth mindset enabled them to work through problems rather than give up.

Students plotted themselves on a student version of the NPDL Character rubric and set goals for themselves using the rubric. Program staff used the Character rubric to identify learning foci for each week of the program. Using the language of other rubrics also enabled Communication and Collaboration, in particular, to be utilized in an authentic way. The success of the program is determined by the students’ successful application of ‘character attributes as learners’ back in regular classrooms.

How has technology changed the world that we live in? This was the Inquiry question that students in Blair’s Year 5/6 learning community explored this term. Blair has a real interest in cars, and the highlight of each week for Blair is the time he spends in his shed at home with his stepdad working on a car engine. The understanding that Blair chose to explore was *Modes of transport have made people more mobile*, and he then refined this to *How does the timing chain keep everything in time in a motor?* Blair said that at the start of his investigation he only knew one thing about timing chains—they keep everything in time. He

identified that he wanted to discover how the chain spun the ‘cam’ and the crank. The majority of his research was done at home with his stepdad, and at school he drew a diagram that he called his ‘information page’ that showed the basics of how an engine works, and outlined what materials he would need to make a model of an engine. During the presentation Blair explained his findings in great detail talking animatedly for longer than ten minutes. At the end of the presentation he was able to summarize his learning—*it’s not really important that it’s a chain, what’s important is that it’s a timer, and that’s important because it keeps every part of the engine working at the right time.*

Student F

Deep learning is inclusive for all! Deep learning instils confidence, perseverance, and provides opportunities for all students to succeed, despite the learning challenges perceived by others or by the individual themselves. This experience is shared from the perspective of a Grade 1 male student. He came to school in September with great anxiety, and low self-esteem due to seeing himself as being “different” from everyone else because he stutters. He would rarely participate or join group tasks because of his fear of stuttering, and how he would be perceived by his peers. He seemed convinced no one would want to listen to him and he was definitely not willing to take the risk.

Early in October we began collaborating with a group of high school students with a diverse set of needs. Since we were not located near this particular high school, we took our learning outside of the classroom walls. Most of the collaboration occurred using Google Apps for Education including Google Hangouts, Google Docs and Google Slides. As this student became familiar with leveraging technology and as collaboration grew, so

too did this student. I think this student became so engaged in the deep learning process: solving real-world problems with his team, having the opportunity to contribute to his own learning through research, and sharing out his ideas in new ways, as well as having his ideas validated by not only his peers but also by high school students, that the risk-taking and speaking just naturally evolved as part of the process. It was beautiful to watch! And that was Grade 1.

The following year in Grade 2 he spoke before our school Board of Trustees to discuss his learning experiences. Here is a quote from his speech: “I still remember when I didn’t talk that much. I never would have thought I could be a public speaker!! So how did this happen? Grade 1, that’s how.” He went on to share even more about deep learning: “I was excited with the learning that was happening in my class. I had choice in my learning, I got to learn with technology and that’s the way my brain works. Most importantly for me, collaboration was expected and happened every day. Collaboration is important to me because my ideas get bigger when I share with other people and then my brain gets bigger.”

Now this student is in Grade 3 and there is no stopping him! Our school gathered as a community of learners to celebrate math and share best practices with parents. This student was leading the “Math Talk” portion of the workshops. He was encouraging parents to collaborate, to participate and validating the ideas of everyone. If I had not been there that September morning to witness this child previously so full of anxiety, so fearful to speak and unable to take risks, I would never believe it could possibly be the same student I now know today.

The above examples are not absent in regular schools, but they also tend to be exceptions to the norm. The point is that they are *typical* in DL schools. Deep learning *causes* more disconnected students to become engaged. They become more likely to participate because learning is geared to each and every student. It becomes the norm for the critical mass of peers and up and down the organization.

3. What is the equity hypothesis?

Students who are advantaged are those whose parents generally have higher levels of education—their parents teach them the attitudes and skills required to persist in school, even in the face of challenges; they coach them in responding appropriately to classes that may not seem interesting or relevant. Some advantaged parents neglect their children or otherwise mistreat them, but that is another story; on the average, students from well-off families have huge social capital advantages. (Still, we observe that the concept of ‘hidden figures’ also applies to students from all social classes who might appear to be well off, but are troubled, or bored).

Students who have historically done poorly in school have parents who love them as much, but their parents may not know how to help them; or given the requirements of multiple jobs, unemployment, stress they cannot handle, and so on, they may not have the time, skills or resources to help. Traditional approaches to education for students in these circumstances can be toxic—boring, irrelevant, and a constant reminder of how inadequate they are. For these students to succeed it is critically important that their teachers and the school help them set high personal expectations, that they learn how to learn and manage their own learning, that they be engaged in learning by involvement in “real world” problem solving, that their learning experiences be

connected to their world and culture. Their learning experiences must engage them and show them they are capable learners.

Paul Tough (2016) in examining how some disconnected students succeed observes that two powerful elements, in combination, are essential: great relationships, and great pedagogy. Relative to the former, Tough shows that kids do well:

“When they feel a sense of belonging at school, when they receive the right kind of messages from an adult who believes they can succeed, and is attending to them with a degree of compassion and respect, they are more likely to show up, ...to persevere longer at difficult tasks, and to deal more resiliently with relentless small scale setbacks” (p. 73).

But, this is also a recipe for tolerating traditional schooling. Show true grit and you can withstand anything! What if we combined such relationship building—the sense of belonging—with great pedagogy—connecting students with real life problems and issues that meant something to them personally, and that developed a sense of purpose, passion and expertise that meant the world to them. That is exactly what deep learning does for those who are most disconnected from conventional schooling.

What deep learning does is:

- Increases self and other’s expectations for more learning and achievement by providing a process
- Increases student engagement in the learning through personalization and ownership
- Connects students to the “real world”, which is often more reflective of their own reality and cultural identity (this can be particularly important for indigenous students)

- Is more aligned to indigenous values and way of knowing (e.g. nature and humans are connected, respect and collaboration as core values, an awareness that differences require empathy)
- Inquiry builds skills, knowledge, self-confidence and self-efficacy
- Builds new relationships with and between the learner, their family, their communities, and their teachers
- Deepens human desire to connect with others to do good

It goes deeper than this. One of the education advisors we work with is Dr. Jean Clinton, A Child Psychiatrist, and Neuroscientist at McMaster University in Hamilton. As she immersed herself in our deep learning work and the 6Cs examples that exemplified vulnerable students tackling problems relevant to their life circumstances, she made a startling observation. Such engagement and learning might, she said, serve to immunize students against further social and emotional difficulties. This could be an incredibly powerful insight. At this stage this is only a hypothesis that we are pursuing, but it is compatible with what we are observing, and cultivating. Dr. Clinton based on her work with thousands of vulnerable children puts it this way:

“The beginning of an idea: a focus on the 6C’s immunizes and protects against social and emotional difficulties thus building positive mental health and resilience. A focus on the 6 C’s levels the playing field for kids from challenging backgrounds.

My thinking is that in a classroom focusing on the 6 C’s there is created a very strong sense of relationship-safety between the teacher, students, students to each other and also importantly the student to the space of learning. For example, in order to create a

collaborative space and stance the teacher has to model empathy and compassion for the differences amongst the group. A focus on communication requires students and teachers to truly listen to the other and ask questions like ‘tell me what you meant’ rather than ‘use your words’.

Clinton continues, “this implies a belief in the competency and capabilities of every child and a belief that every child CAN learn and will do well if they can, and as one group says: it’s skill, not will they need to do well.

So why is this good for mental wellbeing?

1. Stress in a classroom interferes with learning as the brain focuses on threat and survival, (amygdala) releases cortisol and epinephrine, and the ‘learning brain’ the prefrontal cortex goes off line. This becomes the non-teachable moment.
2. Children coming from disadvantage are more primed to read threat in the environment, and move to a survival strategy as the brain is formed by its experience in order to survive.
3. Creating a place of safety and a sense of belonging through leveling the playing field with a focus on competencies that the ‘disadvantaged’ student has can counteract the sense of stress and threat that affects disadvantaged children more acutely.
4. Creating a sense of belonging we know from neuroscience is a huge factor for learning and protection against stress. When you have a sense you belong you release more neurotransmitters, particularly oxytocin, which neutralizes adrenaline and cortisol”.

(Jean Clinton, personal communication, November, 2016).

The students in NPDL with and without their teachers are immersed in the study and attempted resolution of important social problems of the day. It is personal, it is immediate, it is passionate, it is teamwork, it matters, and students learn, learn, and learn some more. Such learning is the best guidance counselor around. Students think about the future as if it were today (and it is). We see in real time the emergence of students as young as 5 as agents of change. In a real sense they live by the motto: *Engage the world; Change the world.*

We are not for a moment saying this will change the lives of students in desperate and life threatening circumstances. Children of all ages will suffer and have their futures limited by their circumstances, and there is only so much deep learning can do to prevent it. But if you are at all concerned with equity you sense the dramatic potential of deep learning for altering the lives and life chances of scores of children and young people. You see the potential for transforming learning and lives on a scale never before achieved. It's a tragedy to continue to serve up, to those already most behind, bad schooling that cements them in the hole in which they were born.

One of our favorite examples with respect to learning environments comes from John A. Leslie, a Junior Kindergarten to Grade 8 school in the east end of Toronto. The school consists of a high percentage (65%) of Bangladesh families who were recent immigrants to Ontario. The principal, Greg McLeod, led the development of a deep learning culture of the kind we are talking about. The children declared themselves as 'change agents' without any prompting. Among other things they studied the differences between 'good water' and 'bad water' countries (Bangladesh was bad; Ontario was good). They also became self-aware about good and bad learning. One morning the principal, Greg McLeod came into his office to find an iPad on his desk with a sticky note that said 'Play me". The video was from the grade one students who proceeded to make suggestions about how their 'learning environment' (using that language)

could be changed to facilitate better individual and group learning focused on important issues. Greg's response: "When 6 and 7 year olds tell you how to improve the learning environment you better listen!"

Let us say it outright about equity and excellence. The 21st century skills: collaboration, communication, creativity, and critical thinking—never caught on. They have been around for three decades. They were stilted, incomplete and rarely implemented with depth. When we added *character, and citizenship, AND* integrated the whole lot in relation to real life problems they came alive. No longer do you have courses on citizenship as stand alone, or character as an antidote to bad schooling. These two forces become integrated with the other four Cs, and as a set became a force for integrated relevance. They became real, and immediate for the learner and the world in which he or she inhabits. Most of all, deep learning—the 6Cs and associated learning—are prime contributors to the equity hypothesis.

4. Proof Points and implications for 'attacking inequity with excellence' whole system change.

In the first section of the paper we saw system change in Ontario 'go to scale' not as a technical or product dissemination, but as a growing and deepening cultural change in the learning relationships within and between all levels of the system. We also saw a shift from top down leadership to middle and bottom up to the point a decade later where co-learning has become the mode. This co-learning is now being focused on the equity and excellence agenda through deep learning. We get the sense that system change for deep learning itself can be accomplished.

The need to go further is being fuelled by radical changes in the world in which we, and our children live. We should not want our children and grandchildren to grow up in the world we

did, nor apparently do they want this world, as we see a huge response to the prospect of students as change agents. In a world of accelerating change and ubiquitous access to information, the antidote to being overwhelmed and feeling powerless is to learn continuously throughout our lives, to learn to influence and to challenge the changes facing us, and to integrate them into our lives in positive ways. Our schools can no longer be places where teachers or departments of education own and direct the learning or where we only pay lip service to wanting our children to “learn how to learn”. From the very earliest grades through to a graduation year, our students need the opportunity to practice owning and directing their own learning, to be excited by the adventure and the work of learning together, and to understand deeply how powerful they can be at changing the world for the better.

A number of social and learning developments are now converging. We take this opportunity to identify what we see as a powerful potential alliance of forces for deep learning that is now aligning (Figure 7).

Figure 7: Hidden Figures



Fullan, 2017

We start at the center of the figure and work outward. Societal solutions will require an all out effort through economic and social policies, parent and community engagement, social agencies, business and other community bodies. Education has to center itself in the midst of this set of solutions. At the heart of the model in Figure 7 are individual learners, what we call ‘hidden figures’. As we stressed, in the world of deep learning *every learner is a hidden figure*. Students alienated from present society are the most distant from learning, but all students in today’s world need to figure out where they fit in a complex global society. Many of these children and teenagers are truly hidden as street kids, foster children, and otherwise outside of mainstream society. Beyond this each and every student no matter how advantaged will at some point find herself or himself at sea in today’s turmoil. Every individual to some extent is a mystery to herself or himself, to each other and to the universe. The role of education is to help individuals come out of their private shells or personal hells in ways that address obstacles, articulate and refine their aspirations, enabling them to enjoy, contribute to and benefit from society. The 6Cs shine a light on hidden figures; the latter in turn illuminate the 6Cs.

The third circle—relationships and pedagogy—takes us back to our definition of deep learning in action. The immediate crucible for development concerns *relationships*, and *pedagogical* possibilities. We define relationships and pedagogy widely to include intra school learning, and external to the school learning through families, communities, and the world at large.

The fourth involves collaborative professionalism that combines autonomy and team work in the service of deep learning. This is the culture of learning that we described in section one concerning Ontario.

The fifth and final component consists of social and educational policies at the level of the state. Social policies pertain to housing, employment, youth development, child protection, minimum income and other elements that we cannot take up in this paper. Education policies concern child-care and early learning, teacher shortage and development, budget and financial investments, accountability requirements, overall vision and goals, and so on. We have said that these policies must be aligned with and reinforce what is happening in the other four domains of Figure 7. For deep learning all five layers must be working in concert.

We contend that an all out attack on inequity with the excellence of deep learning is the only way that all individuals and society as a whole will benefit. We don't have the space to elaborate all the details in this paper, but the essence of the argument with compelling examples can be described.

We can start with the most difficult end of the problem: those who have lived lives under conditions of concentrated intergenerational poverty. What relationships and pedagogy will reach seemingly un-reachable students? Louis Cozolino (2013), to whom we will return shortly with respect to the neuroscience of learning, gets us started:

“In order for teachers to become guides, they need to be familiar with their own shadows...which will allow their students to confront their own inner demons...A successful guide snatches victory from the jaws of defeat, gaining freedom from determinism. The teacher invited the student to take a journey out of the narrow confines of his or her life into a new world beyond the limitations of the neighborhood, family and culture” (Cozolino, 2013: 200).

As a case in point Cozolino takes rookie teacher Erin Gruwell who began her career walking into a high school in Long Beach, California and found herself facing a group of Latino,

Black, and Asian students who could only be characterized as lost causes (Gruel's own account is told in her memoir, *Teach with your heart* (2007)). As Cozolino describes it, Gruwell took a leap to what she called 'lessons that ignite a desire to go beyond the walls of the classroom'. She realized that her job was not just to teach them English, but also to educate them about history, racism and injustice. She took her class to the Museum of Tolerance and found that they were able to relate to the suffering of the Jews. She then gave them journals to write the story of their lives: their problems at home, the deaths of friends and family members to gang violence, and their encounters with racism. She found that as her students acknowledged and shared their pain, the bond they created overcame the racial barriers dividing them. Gruwell was able to help her students make a shift from feeling indifferent and hopeless to empowered and capable. As one of the students had written "Historians say history repeats itself, but in my case I have managed to break the cycle because I am going to graduate from high school and go to college, an opportunity my parents never had" (Gruwell, 2007, p.9).

Of course this fits and even tops the six vignettes we reported earlier. However, the problem is that it is only one extraordinary teacher. The Erin Gruwells come and go, as she did, leaving little systemic trace of their contribution. Our deep learning is about system change, so let's take a bigger example. Russell Bishop, Mere Berryman and their team in New Zealand have made a concerted effort to change the lives of 'indigenous and minoritized students' through education reform (Bishop, 2011, Bishop, Berryman, and Wearmouth, 2014). We appreciate this example because it comes very close to an 'intentional social movement' focusing on Māori students who constitute 28% of all newborn New Zealanders.

Bishop, Berryman and team call their work "a comprehensive approach towards theory or principle based education". Consistent with our own figure 7 Bishop states:

“[Our] model suggested that teachers need to develop pedagogic relationships and interactions: where power is shared between self-determining individuals within non-dominating relations of interdependence; where culture counts; where learning is interactive, dialogic and spirals; where participants are connected to one another through the establishment of a common vision for what constitutes excellence in educational outcomes” (Bishop, 2011,p. xiv).

Over time Bishop, Berryman and colleagues developed an *Effective teaching profile* that has two premises and six components. The premises are:

“Effective teachers:

- a) Positively and vehemently reject deficit theorizing as a means of explaining Māori students’ educational achievement levels.
- b) Know and understand how to bring about change in Māori students’ educational achievement and are professionally committed to doing so.

Teachers are to accomplish this in the following observable ways (we use the Māori words to label the components):

1. Manaakitanga: They care for the students as culturally located human beings above all else.
2. Mana motuhake: They care for the performance of their students.
3. Whakapiringatanga: They are able to create a secure well-managed learning environment by incorporating routine pedagogical knowledge with pedagogical imagination.

4. Wānanga: They are able to engage in effective teaching interactions with Māori students as Māori.
5. Ako: They can use a range of strategies that promote effective teaching interactions and relationships with their learners.
6. Kotahitanga: They promote, monitor, and reflect on outcomes that in turn lead to improvements in educational achievement for Māori students. (Bishop, Berryman, Wearmouth, 2014, p.5).

They develop the capacity of teachers to be this good through a program of: induction, observation tools, individual teacher feedback, co-construction meetings, and shadow coaching. In our terms this would amount to the development of focused collaborative professionalism around a specific set of goals. We stress here that collaboration must have a high degree of specificity and precision pertaining to the outcomes sought.

Students reported that the proportion of teachers exemplifying the characteristics in the teaching profile ‘had increased markedly’ (Bishop et al, 2014,p 64). Student comments reflected this development: “you know, they sit you down and explain things, don’t make you feel dumb” (p. 65); students in Years 12 and 13 reported that “they had observed that how teachers had changed the way they supported and related to Māori students during the time they had been at the school” (p. 68). A Year 13 student said, “at this school I have grown so much. I have become me, probably because of this school, and I have been empowered. I’m an empowered young woman” (p. 85). An ‘in class observation tool’ showed a general trend of improving student-teacher relationships over a two year period.

In another publication Bishop, Ladwig and Berryman (2014) make the convincing case that, not only are relationships key, but also they are *foundational* to pedagogy. In other words effective pedagogy depends on developing relationships with the learner. For students with different cultural backgrounds it is especially critical that they can bring their own cultural experiences to the learning. Bishop et al and ourselves of course are not the first ones to make this point, but we are among the first to link relationships and pedagogy in the service of equity and excellence on a large scale.

The point is that this combination of belongingness and connection on the one hand, and engaging pedagogy on the other hand *works!* In Bishop's case several schools showed gains of some 15% in a variety of student achievement measures over the course of three years. While implementation varied across schools depending on leadership and leadership turnover, the overall trend showed increased performance of Māori students, and reduction in, and in some schools eliminating, the performance gap between Māori and non-Māori students. In an independent evaluation report the NZ Ministry of Education (2015) drew these conclusions:

- The achievement of Māori students (as measured by NCEA levels 1–3) in Phase 5 schools improved at around three times the rate of Māori in the comparison schools
- While the achievement of the comparison group deteriorated following the realignment of NCEA achievement standards, the achievement of Māori students in Phase 5 schools improved
- By 2012 the achievement of year 12 Māori in the Phase 5 schools (mean decile = 3: in NZ schools are often compared by deciles defined according to SES) was on a par with the achievement of year 12 Māori compared across all deciles

- The proportion of Māori students returning/enrolling in year 13 (in 2012, equivalent to two-thirds of the 2011 year 12 cohort) increased markedly in Phase 5 schools
- By 2012 the number of year 13 students achieving NCEA level 3 in Phase 5 schools was nearly three times what it had been four years earlier
- The proportion of Māori students from Phase 5 schools who were at least 17 at the point of leaving increased at twice the rate for Māori nationally.

You might say New Zealand was on the way to whole system change. But the government inexplicably stopped the funding in 2013 citing budget cuts, and turning their interests to other programs. In economic terms it is well known by economists that programs that help students in poverty succeed return 5 to 7 times the economic benefit because of money on saved health, welfare, incarceration etc, let alone taking into account the prosperity and earnings of successful students. This of course is the policy component in our Figure 7, and reminds us that all five circles of the figure must be aligned.

Once you get the idea that we need an all out assault on inequity through excellence the ideas will come streaming through. We maintain that we haven't even tried yet, and the good news is that breakthroughs in learning and brain science will provide a steady stream of low cost high yield ideas for attacking inequity. One of these was reported in the Toronto Globe and Mail on Monday February 20, 2017. Experiments at the Royal Conservatory of Music showed that bouncing babies and young children on one's knee to the sound of music stimulated cognitive growth. Dr. Sean Hutchins observes that "music is a complicated type of system with all kinds of social cues going into it—complexity that the mind tries to make sense of". Passive listening, to Mozart for example, doesn't do the trick, but music with physical movement does.

A New York Times article the day before (February 20), reporting on a kind of ‘hidden figures’ strategy, describes how 75 students with a high aptitude in math from New York City public schools in poverty were selected to apply for an intense math summer program. Many of these students flourished; “I can’t stop them from doing math” observed one teacher.

What if instead of thinking that there are a small number of geniuses lurking in poverty that we assumed that there are scores of hidden figures that could be doing far better than they are if they were only sought and cultivated! That is what ‘the social neuroscience of education’ is telling us according to Louis Cozolino (2013). Certain life conditions and experiences shut down learning, others do the opposite, and with careful treatment can rescue those who get off to a bad start. Says Cozolino:

“teachers who are able to tap into the primitive social instincts of their students through attachment relationships...succeed in seemingly impossible educational situations. Over and over again...[these] teachers find ways to teach students thought to be “unteachable” (p. xxiv).

Cozolino’s central point is this: Insecure attachments, a dangerous environment and chronic stress can create a perfect storm of biological and epigenetic consequences that can turn the brain off to learning. On the other hand, caring as supportive others can create a state of body and mind that primes our brain for curiosity, exploration, and learning” (p.50). The good news is that the damaging effects of a bad life, as we saw with Erin Gruwell’s students, can be reversed (and if you look closely a poor life transcended can produce an even stronger and insightful person than those who have had an easy pathway).

There is one more fundamental point that must be made. If teachers are to get close to the equity and excellence hypothesis, they too must undergo a transformation. The solution is not simply developing relationships with children and youth different from oneself. It is not just about caring. Teachers, especially if they are from backgrounds different from their diverse students, will have to tackle the complex reality of their ‘new’ students. To do that effectively teachers will have to undergo a transformation themselves —their formation, their perspectives, their need to interrupt and confront bias, their need to confront their own privilege and the impact it has on how they teach students different from themselves (our thanks to John Malloy for identifying this powerful neglected issue). A key part of the solutions for educators is *what needs to change in me* so that I can better serve my students. This may be the biggest elephant in the room, but also the richest route to breakthroughs in attacking inequity with excellence. Actually, this is deep learning turned inward; to be a deep learning educator is to engage in such learning oneself.

Conclusion

When teachers attack inequity with excellence they find damaged students with huge potential. When these students start to succeed compared to ‘mainstream students’ teachers come to the realization that there are no mainstream students. Put another way, the old paradigm of acquiring knowledge and content is no longer meaningful for *anyone*. When you make life experiences meaningful and a basis for learning for minority students, it dawns on you that regular schooling is not that relevant for mainstream students either! When you address the life related learning needs of minorities you are inevitably led back to what is meaningful for all students.

Now we have a level playing field because the question is learning for all. Deep learning is about humankind's relation to the world; it is essentially learning that transforms the physical and social world as it transforms oneself and those around them.

We might end by asking 'what is deep about deep learning'. In our recent experience in implementing deep learning in seven countries there are 10 big factors that distinguish deep learning from traditional 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.

Several factors are making deep learning, as we have defined it, not only more probable, but also likely to rapidly accelerate in the next five years. These factors include:

- a) Direct policies that promote racial equity and social justice while penalizing racism, bullying and other behaviors that serve to discriminate against subgroups;
- b) An increasing understanding of learning and how it happens (particularly that relationships and pedagogy are intimately related);

- c) Growing insights about how the brain works (both in terms of how we can enable faster and deeper learning, and how we can reverse the damage caused by poor starts);
- d) The development of the world-wide web along with its prodigious power (for better and worse) to connect everyone and everything;
- e) How helping humanity, changing the world, and developing ourselves are intimately related;
- f) How there are a growing number of groups around the world innovating, studying and looking for breakthrough solutions;
- g) The fact that the world is askew and everyone seems to know it, generating anxiety and fear, along with a search for and openness to radical new solutions;
- h) Finally because much of the energy and verve are coming from the bottom (students and teachers), and the middle (leaders at the school, district and municipality levels) i.e. the educated masses (the younger the better) will be pushing for, and in many cases are, leading the way.

At this stage DL appears to be a powerful answer to a world out of control but laced with dynamic learning opportunities. DL creates a purposeful and effective intersection of two critical dimensions of education: academics and wellbeing. It moves us from pursuing these as two separate endeavors, where academics take precedence in classrooms, and wellbeing is delivered in character education programs and extra-curricular activities, into a more holistic approach. DL also bridges academics and action. One feeds the other. DL also positions learning as seamlessly integrated with transforming the world as we transform ourselves (or is it the other way around?). In either case, ‘engage the world, change the world’ is a deep learning proposition.

All other approaches to system-change, deep learning, and achieving equity and excellence have failed. In the meantime the situation worsens. School choice, for example is a slow boat to system change, often it exacerbates the achievement gap between groups of students, at best helping a few people while it weakens, and may destroy the entire edifice—a boat that will sink before it arrives.

Even major analyses that zero in on equity and outcomes misses the high leverage possibilities of using relationships and pedagogy to attack inequity and excellence. The OECD report on ‘enabling teachers to improve equity and outcomes for all’ that was produced for the ‘International Summit on the Teaching Profession’ is a case in point (Gomendio, 2016). The report notes that only five countries in the world achieve both high equity and high achievement on PISA assessment (and this is by no means the deep learning that we are talking about in this paper). The solutions recommended consist of policy actions that are several steps removed from the day-to-day *learning experiences* that we have identified in the second half of this paper. We agree with the specific policy recommendations: high quality early childhood learning, supporting students with low SES, tackling dropouts, helping low performing schools, helping immigrant students, autonomy combined with collaboration, and so on (Gomendio, 2017); but these steps are not nearly sufficient; they lack the powerful specificity of deep learning actions that we discussed in relation to our equity hypothesis.

The solution lies in developing personalized relationships linked to engaging pedagogy based on fostering measurable global competencies such as our 6Cs. So far this work is receiving scant attention from policy makers. It has all the potential of capturing the motivation and energy of all students, especially those most disconnected from conventional schooling. And it can certainly capture the motivation and energy of teachers as they see the results. DL is different

because it galvanizes the imagination, passion and commitment of masses of students and educators. It helps the individual and helps humanity simultaneously. It is a social movement that can be shaped, but then determines itself, to be shaped and reshaped again and again. One other bone of contention: the OECD report defines equity in terms of ‘high quality opportunity for all’. We beg to differ; it is equity and excellence of *outcomes* that matter. This is to say that no subgroup should do worse than any other subgroup on the average (take the 6Cs as an example).

Finally, we forecast that deep learning will soon cause humans to discover that learning and life on this planet (and beyond) is fundamental to what it means to be humans. Paulo Freire, John Dewey, Maria Montessori, Reggio Emilia and others were on to this discovery decades ago, but there wasn’t the confluence of factors that are now proving their point. The thesis is this:

1. Humans can only learn deeply when they see themselves connected to the physical world.
2. They can only learn deeply through conscious actions to transform the world as a vehicle for their own learning, making them inside not separate from the world.
3. Relationships with other humans are indistinguishable from being human, and from the actions pursued in points 1 and 2.
4. Equity of deep learning outcomes is at the heart of points 1-3; indeed it is at the heart of healthy societies.

Connecting with the world, and with each other in a constant state of understanding and responding to the mysteries of life in this universe is deep learning. Education as deep learning makes education the ultimate change agent for societal evolution. It may not seem that this could

be so in the tumultuous times of 2017, but evolution is on the side of enhancing humanity. Attacking inequity with excellence through deep learning is none other than the evolution of humankind in a complex universe.

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